NATURE

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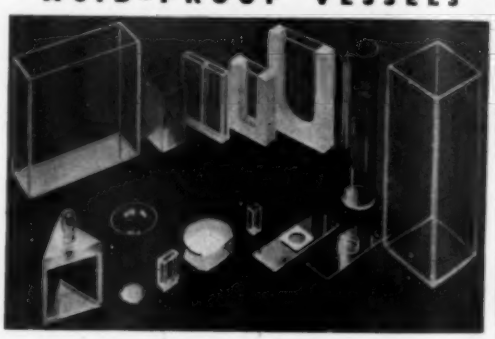

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SCIENTIFIC UTILIZATION OF RESOURCES AND MAN-POWER

THE Select Committee on National Expenditure has from the start taken a wide view of its functions, as an admirable series of reports testifies. Appointed to examine the current expenditure on the war services "and to report on what, if any, economies consistent with the execution of the policy decided by the Government may be effected therein", with its team of sub-committees, the Committee has constituted itself a body for keeping Government departments up to scratch in many matters which have only an indirect bearing on the war effort. None of the reports yet issued by the Committee more fairly earns the thanks of the nation than the third and fourth reports, recently published, both of which discuss questions of man-power and production. That in its third report the Select Committee should have found it necessary to recapitulate at length the experience in regard to the relation between industrial output and hours of work, is the more disquieting in view of the seriousness of the man-power situation. The warning, it will be recalled, had already been given in a report issued by the Home Office early in the War, on hours of employment of women and young persons in factories, and in a later report prepared by the British Association for Labour Legislation.

The Sub-Committee on Supply Services of the National Committee now reports in fact that the lessons which the War of 1914–18 should have taught seem largely to have been ignored in respect of overtime and hours of work. Even if the demands on man-power had not been accentuated in the present struggle, failure to profit by past experience could not but handicap our efforts. A like failure to learn the lessons of the past is implied in the fourth report of the Select Committee, on contracting. The co-ordinating sub-committee which submitted the report rightly observes that if maximum output is to be achieved the expenditure of national reserves—whether in man-power, in materials, or in capital equipment—must be at a minimum for each unit of output, and one indispensable method of bringing this about is to pay the closest attention to sound methods of contract procedure.

The prime necessity in a war economy is for the maximum and most efficient use of man-power and materials, and from the point of view of the elimination of waste this latest report is probably the most valuable of the eighteen that have so far appeared. Any contract price will contain four elements: the cost of materials, the cost of labour, overhead costs and profit, to which in main contractors' costs must often be added a fifth, payments to sub-contractors. The control of costs is, therefore, the simplest method by which to attain the maximum efficiency. The acute analysis of cost control and departmental organization, and the masterly survey of the conflict between urgency and carefulness in placing contracts, are examples of lucid thinking which should give the report an assured place in the literature of scientific management, carrying implications far beyond its immediate purpose.

The report indeed makes a distinct contribution to the scientific organization of our war effort, on the positive side as well as from the negative aspects of eliminating waste. With the details of this report only a few scientific workers, and chiefly those in administrative positions, are directly concerned. The report recommends a fixed price contract as the best type of contract. When a target is used with a maximum price

contract, sufficient inducement should be given to the contractor to effect savings. Closer scrutiny should be given by departments to the costs allowed for labour on costed contracts, with the view of securing that it shall be employed in the most efficient manner, and severe comment on the time lost in doing all over again the costing and inspection work of reliable and experienced firms, and in doing it in several departments, leads to recommendations designed to avoid such waste and to stop duplication of costings by different State departments.

Great importance is attached to the fullest use being made of the capacity of small firms, and to the financing of such firms properly where necessary. The absence of co-ordination of departments is again the subject of severe strictures, although the difficulty of correcting inefficiency or economic defects is recognized. The importance of careful examination of departmental organizations to secure the maximum co-ordination in future planning, to ensure the allocation of labour to the best advantage, and of the effective tackling of the question of training and securing of potential labour, is stressed.

It is significant that the report should have to recommend that all constructional building, with the exception of fortifications and defence works, construction of aerodromes and works overseas, should in future be the responsibility of the Ministry of Works and Buildings. Similarly, the recommendation that the purchase of general stores, clothing and personal equipment should be the function of a separate new branch suggests that the work of allocating duties to the departments best fitted to receive them is not yet complete. The waste, inefficiency and lack of co-ordination brought to light, not for the first time, in this report should not be allowed to persist. It would indeed be deplorable if there were any delay in implementing the findings of this valuable and suggestive report.

As has already been indicated, the third and fourth reports have some ground in common. Looking at the matter from the point of view of economy, the fourth report points out that to meet the demand for speed by heavy overtime is not only costly, but also, as has been shown on many occasions, after a short period of application, causes a high sickness rate and other losses of effort symptomatic of industrial fatigue, and will finally result in an actual decrease in output. The third report deals with this question at greater length, three of its sections dealing with overtime, dilution and training of labour, and with the effect of overtime on costs.

Before the increased drive for production began in May last, the Sub-Committee on Supply Services was perturbed at the amount of overtime which was being worked. Excessive overtime was found to be bad for production, while if a certain amount of overtime was not worked, men left their factories for others where they could earn more by working overtime. These symptoms were intensified as a result of the two months of extreme effort following the Government's appeal after the invasion of Holland and Belgium. Absenteeism became much more common and men arrived late for their work. Sunday labour led to men taking a day off in the middle of the week, when, of course, they only lost an ordinary day's pay. When at the end of July, in the Royal Ordnance factories, where absenteeism had risen to 15 per cent, it was decided to discontinue Sunday labour wherever possible, and very often Saturday afternoon as well, time-keeping improved and production did not suffer, or even increased.

The Sub-Committee accordingly strongly recommends that hours of work should be reduced to those set out in the Ministry of Labour's July circular as soon as possible. It is also essential that any reduction should be generally applied, in order to prevent men moving from one factory to another in search of longer hours and more pay. Only so can adequate account be taken of the four general facts, established during 1914–18, but recapitulated here so firmly and clearly by the Sub-Committee: increased hours of work above an optimum which varies slightly with different industries do not increase output proportionately, and may even result in a decrease; when heavy overtime is worked for prolonged periods, the general health of workers is undermined; if overtime has been prolonged a reduction in hours will increase output, though there will be a time-lag corresponding to recuperation of energy. If general health is undermined, a reduction to optimum hours will fail to effect the required increase of output.

A major cause of industrial fatigue is eyestrain, and the report recommends full and urgent investigation of the interior lighting of factories and workshops. The requirements of the black-out make it essential that methods of lighting scientifically devised to protect the worker from eyestrain should be fully investigated. It is also

recommended that the 'spotter' system of roof-watching to avoid loss of production during air-raids should be linked up with the Observer Corps, and that the removal or wiring of glass in the roofs of workshops should be expedited.

The main obstacle to the abolition of excessive overtime is the shortage of labour, especially skilled labour. The remedy for this is dilution and training, and the Sub-Committee considers that there should be a continued drive to attain the maximum dilution of labour. Once more it is urged that the compulsory powers regarding the movement of labour should, if necessary, be fearlessly used. It is particularly desirable that more training should be done in the factories themselves, in addition to the training centres set up by the Ministry of Labour. Moreover, excessive increase in costs is attributed to abnormal overtime increasing costs out of all proportion to the increase in production. The Sub-Committee records its opinion that this situation, in view of experience during 1914–18, should never have been allowed to rise. It accordingly recommends that more attention should be given by the costings department to labour costs, and action taken when they appear to be too high.

The regularity with which examples of failure to profit by past experience occur in these reports is one of their most disquieting features. No less disturbing in its implications is the admission that the Sub-Committee has so far been unable to see the actual costs of scarcely any articles which have been delivered since the War began, so that it has been unable to find out so far whether in its judgment the State is in fact paying too much for its war supplies. Such an admission is more than an indication of inefficient administration and inadequate checks on excessive costs. It amounts to thwarting the prime purpose of Select Committee to watch over expenditure on the war services.

The wide view of its functions which the Committee has displayed in its reports, and the admirable balance of the reports, have won it already an established reputation, and its findings cannot be ignored without danger to the public weal. Even where, as in these latest reports, it makes numerous recommendations in matters of detail, such as constructive suggestions for preventing a break in production and unnecessary use of paper in sending out tenders and drawing up contracts, it is always clear that the wider issues are kept in mind, and that both policy and detail are being sifted by keen, analytical minds, untrammelled by tradition or departmentalism. The warnings conveyed so clearly and firmly in these latest reports are unmistakable. It is for scientific workers, with their fellow citizens, to see that there is no hiatus between this lucid thought and swift decisive action to eliminate the waste and handicaps which inefficient management, departmentalism or impatient but mistaken disregard of past experience, are placing on the development of our resources to their maximum capacity.

AMERICAN VIEWS ON MODERN CULTURE

Science, Philosophy and Religion

A Symposium. Pp. ix+443. New York: Conference on Science, Philosophy and Religion, 1941.) 1.50 dollars.

THE papers contained in the present volume were prepared for a conference held in New York during September 9–11, 1940, the subject of the conference being "Science, Philosophy and Religion in their Relation to the Democratic Way of Life". Those who initiated the conference maintain that "civilization itself is threatened by the rise of totalitarian systems based on various anti-scientific, anti-philosophic, and anti-religious dogmas". They state—it is perhaps a hope rather than a conviction—that "our common background gives us a broad basis for a united, democratic American way of life". "This way of life must be based ultimately on the religious principle of the Fatherhood of God and the worth and dignity of Man when regarded as a child of God". The conference after its meeting appointed a committee to meet representatives of the Press: this committee overcame the temptations of humility and pronounced the papers submitted to be "contributions of unusual merit to American learning". Further meetings are planned to take place in 1941 and 1942.

In the volume before us there are, including two introductory papers, twenty-four separate contributions. They form a somewhat closely printed and substantial volume. Naturally, they are of varying length—and value. Practically all their authors are associated with American universities,

an exception being the French Catholic philosopher, Jacques Maritain. (Throughout this review I shall refer to writers without honorific prefixes: the constant iteration of the title 'Professor' is irritating.)

As one reflects upon the plan of the conference and reads the resulting contributions, two questions of primary importance arise. Is there any vitally intimate relation between some particular political system and the true progress of science, philosophy and religion? Can any unity between these branches of knowledge be made effective at the present time? As regards religion, Christianity was born under a government which, though nominally that of an oligarchy, was in reality a military despotism. Philosophy came to its first maturity in the great days of Greece when Athens was a democracy with, however, a slave basis. It emerged in Christian Europe in the twelfth century when homes of learning, the monasteries, were an integral part of a feudal society. Science began its modern development when the Renaissance, followed by the Reformation, freed and stimulated the minds of men. Some of us would contend from these facts that there is no close connexion between political systems and the growth of true understanding. It is freedom to examine, to speculate, to question all theories and beliefs, which is vital to science. Without freedom of the mind, the philosopher works in chains, and the religious reformer chafes in sullen rebellion. The pluto-democracy which has evolved in the United States is not alone in giving such freedom.

Karl Darrow, of the Bell Telephone Laboratories, writes one of the most valuable contributions to the volume before us. He describes, accurately and not with the allusiveness which is too often a pretentious avoidance of careful thinking, the various revolutions in the fundamental ideas of physics which have taken place during the last half-century. His paper ends with the blunt inquiry: "But what has all this to do with the democratic way of life, or with the contrast between democratic and totalitarian systems"? He answers:

"So far as the development of physics in particular and science in general is concerned, what it seems to require is a supply of talented people enabled and permitted to go their own ways, so that discovery may occur in whatever logical or capricious or ironical ways may be chosen by destiny. Non-interference is essential. If a government discourages some doctrine of physics because of a fancied clash between it and some political or economic dogma, it is adverse to physics. (Other sciences are more exposed to this danger, but even physics has not been exempt.) If a government impedes the free passage of scientific men or scientific writings to and fro across its frontier, it is adverse to the development of science even within that frontier. If a government denies opportunity to a group which has a great aptitude for science, it is doing harm to science within its own dominion, though some of the harm may be repaired by the benefit to science in other countries from the resulting emigration. If a government extinguishes a class which by breeding and inherited tradition and leisure is devoted to things of the mind, it is doing irrevocable harm to science. Everyone knows that it is mainly in totalitarian states that these things happen."

The quotation is long, but its content is good, sound sense.

The modern world reaches unity in its scientific conclusions. Is any unity possible in the domains of philosophy and religion? The present volume answers that question with an emphatic negative. There is no agreement as to "the religious principle of the Fatherhood of God". There is, moreover, no attempt to reach philosophical or religious unity. Mortimer J. Adler said truly: "The members of this Conference are not co-operatively seeking to agree about the truth, through the painful ordeal of intellectual debate. Each is content to express his own opinions, and to indulge everyone else in the opportunity for similar self-expression". Adler makes a forthright attack on the modern American professor. The latter avoids "what is demanded for fruitful intellectual procedure". "He will not subject himself to the rigours of public disputation". "He is indocile in the sense that, beyond the field of science, he cannot be instructed, because he acknowledges no ignorance". Is it wrong for an English ecclesiastic, remembering the history of the nineteenth century, to read these words with quiet pleasure?

Adler probably intended to expose the weakness of the present volume. It should be, and is not, constructive, a patient attempt to expose differences and to show what measure of unity is possible. Einstein, for example, contributes a brief paper in which he re-affirms the absolute determinism which is his philosophic creed:

"The more a man is imbued with the ordered regularity of all events, the firmer becomes his conviction that there is no room left by the side of this ordered regularity for causes of a different nature. For him neither the rule of human nor the rule of Divine Will exists as an independent cause of natural events."

So, says Einstein, religious teachers must give up the doctrine of a personal God and "avail themselves of those forces which are capable of cultivating the Good, the True, and the Beautiful in humanity itself". We may challenge Einstein's

metaphysics, as we may challenge that of Newton, without denying his greatness. The arguments in favour of his denial that the human will exists as an independent cause of natural events are, it has often been said, overwhelming—apart from the fact that the conclusion is contradicted by our daily experience. If Einstein is right, what are justice, mercy, honour but fancies which please us without affecting the course of events one jot. Whence come "the forces capable of cultivating the Good, the True, and the Beautiful"? The term 'forces' is doubtless a metaphor, but of what reactions are they aspects? How can the cultivation which Einstein demands have results? Such questions are not missiles in a barren controversy. They raise issues vital to our civilization. The place of moral ideals in naturalism, or in similar creeds which reject a personal God, is not adequately answered by Harry A. Overstreet. Overstreet holds that when "the child-like religionist grows up," he dispenses altogether with the person-like word 'God'. "His religion is mature when he can say: "I believe in love, creator and sustainer of life. To the realization of love-in-life I devote myself". There are too many loose ends in this preaching. What relation has it to the stuff of which the universe is made or, I personally would add, to the mind which gave it form?

It is perhaps too much to expect a neo-Thomist to join in constructive debate with men for whom his postulated entities are unintelligible. Maritain makes his demands clearly, but the answer, as I see it, can only be a polite 'if you think so, you think so'. In the less skilful hands of Anton C. Pegis, a defence of neo-Thomist philosophy takes the form of an attack on William of Ockham as the empiricist forerunner of the emancipated modern man. It leads up to the assertion that the liberation of the modern man is "a liberation from reason, from universality, from intelligibility, from order and from law".

Such Catholic philosophy is curiously indifferent to critical investigation of the New Testament: and yet the results of such investigation cannot be ignored if the Christian religion is to be integrated into the new cultural unity of the Western world. For this reason it is much to be regretted that in the volume before us there is no attempt to summarize the form which Christian belief must take as a consequence of our new knowledge of Christian origins. William F. Albright's discussion of "Archæology and Religion" is marked by an ultra-conservative bias. Some statements in it, as for example that recent papyri finds refute the idea that certain parts of the New Testament can be as late as A.D. 150, cannot be accepted. A dislike of "modern religious humanism" and the attribution to unspecified opponents of "the rationalistic dogma that all can be explained in terms of mathematics" are not adequate substitutes for a patient re-presentation of the essential principles of Christianity. Donald W. Riddle's "New Testament Study and the Time-Lag" does not supply the need. It is a relatively slight sketch of the history of New Testament critical scholarship. As the author writes of the time-lag, it is worth noting that he does not seem to have known that, when his paper was given, Loisy was already dead.

What has happened to the study of Latin in American universities? On p. 93, we get *sub speciæ*: on p. 95, *humane laudis amore*: on p. 165, *ignorabinus*. Copernicus would be astonished to find that he wrote a book with the title "De Orbinum coelestium Revolutionibus"; but Vesalius would be even more surprised to find that he was the author of "De humani corpori fabricia". ?

E. W. BIRMINGHAM.

VICTORIAN TRAVELLER

The Rugged Flanks of Caucasus

By John F. Baddeley. Vol. 1. Pp. xv+272+22 plates. Vol. 2. Pp. ix+318+15 plates. (London: Oxford University Press, 1940.) 126*s*. net.

MR. JOHN F. BADDELEY, the author, died a year ago at the age of eighty-five, just when he had made this book ready for the press. It is the narrative of his travels of some forty years ago.

As a very young man chance took Mr. Baddeley to Imperial Russia, and later on he engaged in business in connexion with the Caspian oil-fields, business which allowed him sufficient leisure to divert himself by riding on horseback for weeks together in and about the northern flanks of the Caucasus. Well versed in Russian, he relied on his servant and guide, an Ossetine, and a man of some standing among his own people, to act as interpreter among the tribesmen, by whom he was received with unfailing hospitality.

There is no doubt that the simplicity of Mr. Baddeley's tastes, his good sportsmanship and generosity, added to his genuine goodwill towards his fellow-men, made it possible for him to achieve an unusual intimacy of contact with the Caucasian villagers. He ate as they ate, slept where they slept, and listened eagerly to gossip, story and song by the fireside. All that he saw he recorded

with care, and because these wanderings were among his happiest memories, the old note-books, diaries, photographs and sketches were brought out long afterwards in the days of his retirement and fashioned into a book.

The world Mr. Baddeley pictures is a vanished one, for he never revisited Russia after the War of 1914–18 and the Revolution. Yet he continued to interest himself in the history and literature of the Caucasus, and this travel record is enriched with the musings, memories and studies of the author's later years. He was able, for example, to compare the country as he saw it with the pictures drawn by many earlier travellers, incidentally indicting Klaproth of plagiarism and fraud. The Ossetines, the Galgais, the Khevsours and the Ingooshees were among the peoples visited, and the author has much to say of their legends, folk-lore, religious observances, manners and customs. He made, too, such notes on ethnology, archæology, plants and animals as the neighbourhood afforded.

The day has passed, however, when the untrained, unscientific traveller can do more for the scientific investigator than tell him, perhaps, that there is something worth investigating. This is a work to be read for pleasure, the pleasure that can be derived from good English prose, from a finely produced book, and from the companionship of the unassuming young man who rode among the mountains, as well as of the well-read older man who lived among his books. A vice-president of the Georgian Historical Society, Mr. Baddeley was the possessor of a fine library of Georgian history and literature, from which he drew the copious annotations to his earlier travels which add so greatly to the interest of the volumes under review. This collection of books and journals he left to the London Library at his death.

MAKING AND BREAKING ELECTRICAL CIRCUITS

Electrical Contacts

By G. Windred. Pp. xii+403. (London: Macmillan and Co., Ltd., 1940.) 16*s*. net.

A GREAT deal of the results of research on technical problems remains in the form of papers in scientific and technical journals, not always easily accessible. A text-book which brings together the salient features of such specialized work can, therefore, be of great value, but the difficulties in writing such a book are numerous. In the first place, it may date quickly; secondly, a choice must be made as to whether the book is to appeal to those already specialists in the subject, or to those who have only a passing acquaintance with it. In either case the principal value of the book will lie in making a specific contribution to the subject by tying together as many loose ends as possible and getting the whole subject into correct perspective.

The book under review, however, appears to have augmented, rather than diminished, the number of loose ends, and includes some that do not actually exist in the subject. Mostly, too, there is very little real attempt to systematize existing knowledge. One of the reasons for this is that the author has tried to cover much too wide a field; another, that he evidently is very much more at home in practical matters than in theoretical argument. In spite of its defects, however, parts of the book will no doubt find a field of usefulness for students and those who have a general, but not too specialized, interest in the subject.

Chapter i is the only one which deals with contact theory proper. It is an interesting chapter, though here too there seems to be a lack of co-ordination and of completeness. The next two chapters, on joints in electrical conductors and on switch contacts, are purely descriptive and derive very little from the results established in Chapter i. Both these chapters are very uneven, with a tendency to repetition which can scarcely be excused.

Next come two long chapters, headed "Circuit Phenomena" and "Arcs and Discharges". Neither is actually germane and both are inadequate. The chapter on circuit phenomena begins with three pages describing resistance, capacity and inductance, which is surely superfluous in a book to be read by electrical engineers. It then goes on for the next forty pages to give a most elementary account of simple series single-phase circuits, including one or two equally elementary errors. The information offered concerning contacts might have been given in a couple of pages—indeed, it has practically been dealt with in the previous chapter. The chapter on arcs and discharges could only be justified if it were completely up to date and if exhaustive use had been made of this information in later chapters, in which case it should have come earlier. Instead, the treatment is so restricted that little application to contacts or circuit breaker problems can be made. The properties, or even existence, of the arc column (or plasma), which plays such a vital part in high-power circuit breakers, is barely mentioned. Arc suppression is dealt with under two headings—"Suppression Circuits" and "Arc Dispersion". The first is useful, but takes up too much space, while

the second contents itself with the description of a few of the principal types of high-power circuit breakers. It is difficult to see why this should have been included. Switch contacts are fully described in a previous chapter (iii), including those used in high-power switches, whereas the subject of circuit breakers proper would require a volume or two to do justice to present knowledge. This part of the book, too, suffers from what might be called a failure to indicate scale. For example, multiple break is certainly advantageous for a certain range of voltage, but is much less so for low or high voltages.

The remainder of the book—two chapters on contact materials and "sliding contacts"—is better, even though the former tends to be somewhat of a catalogue of physical properties. The discussion of the properties required of contact materials might very well have been greatly extended, particularly on such aspects as contact bounce, contact wear and so on.

The indexing could be greatly improved; examples taken at random are "restriking voltage" and "recovery voltage", for which the index is of little help in showing one where to find an explanation of the difference between these terms.

It is to be hoped that in the second edition the author will enlarge the first three and the last two chapters at the expense of the others, and that some attempt will be made to form a logical structure in which the gaps in our present knowledge appear as missing steps and not merely as things one might like to know. At the moment, the book tends too much to the popular science type, namely, a collection of interesting facts arranged under headings, but with no proper background. Perhaps this is partly the fault of the present state of the subject.

Pleasing features of the book are its handy size, clear illustrations and imposing lists of references at the end of each chapter.

A. Morris Cassie.

CHILDREN'S IDEAS OF DEATH

The Child's Discovery of Death

A Study in Child Psychology. By Sylvia Anthony. (International Library of Psychology, Philosophy and Scientific Method.) Pp. xvi+231. (London: Kegan Paul and Co., Ltd., 1940.) 11*s*. 6*d*. net.

THIS is an investigation of the idea of death possessed by children of various ages, and of their emotional reaction to this idea. It is partly experimental (using the story-completion technique devised by Prof. Piaget of Geneva) and partly observational. The explanatory principles used are largely those of psycho-analysis, and the inquiry is motivated not merely by academic curiosity but also by the problems of the practical care of children, which are more than usually important at the present time.

The author finds that young children think more about death than is commonly believed, and that they are, in general, less prone to anxiety about it than adults suppose. She does not, therefore, defend the common grown-up desire to protect the child from all perception and thought of dead things or of death. On the other hand, she agrees that it is desirable to avoid stories or expressions of attitudes which tend to give ideas of death a frightening or horrible character. She also agrees with the psycho-analysts that feelings of guilt connected with the death of other people are common in children's fantasies on this subject, and suggests that the adult may help to relieve the morbidity of these feelings of guilt by allowing the child to express feelings of hostility as well as of affection towards those who have died.

In studying the development of ideas of death with advancing intelligence, the author finds a first stage (generally at less than five years of mental age) in which no meaning appears to be given to the word 'dead'. Later (from about six years of mental age onwards) there is clear understanding of the concept with reference to human beings, although it is some years later that reference is made to logical or biological essentials in explaining the meaning of death. The recognition of the inevitability of death in others generally precedes recognition of the inevitability of the child's own death, and this latter may be found an idea too painful for ready admission into consciousness, and ideas of living for ever may be elaborated.

A lasting refusal to allow into consciousness the idea of the reality of death may lead to a disintegration of personality through a perpetual conflict between reality as the child sees it and the reality which is a basis for the society he lives in. Such a refusal may be due to an inborn predisposition to reject unpleasant ideas, but the author is more inclined to the idea that it commonly results from such an emotional experience as the too early loss by death of a loved person which makes the idea of death more than normally painful at the critical stage. In either case the child will need psychotherapeutic help, and the understanding adult may help to avoid a repression of this kind by avoiding a morbid expression of the idea of death by his or her own words and example.

R. H. Thouless.

Chambers's Technical Dictionary

Comprising Terms used in Pure and Applied Science, Medicine, the Chief Manufacturing Industries, Engineering, Construction, the Mechanic Trades. Edited by C. F. Tweney and Dr. L. E. C. Hughes. Pp. viii+960. (London and Edinburgh: W. and R. Chambers, Ltd., 1940.) 15*s.* net.

AN accurate and reasonably comprehensive technical dictionary has become an almost indispensable adjunct to the equipment of the scientific worker, and also to that of the layman who desires to march with the times. The prodigious growth of knowledge in the natural sciences and their applications has, moreover, necessitated the coinage of a multitude of new words, and if a majority of these can be found, alongside the old ones, within the limits of a single volume, much time is saved and efficiency gained. No single technical dictionary can aspire to completeness, but every good one should include the essential words and expressions, and be available at moderate cost.

Judged by the above criteria, "Chambers's Technical Dictionary" comes out very well indeed. It contains an extraordinary amount of condensed information, which, so far as the writer is competent to judge, is both reliable and up to date. Brevity is naturally its soul, and should the specialist complain that excessive condensation must entail slight inaccuracies, his remedy is to consult an encyclopædia and not a dictionary. A minor criticism can be advanced against what appears to be arbitrary classification, for many of the words included in one or other of the 124 categories which the authors have adopted might equally well have been placed in another. Thus there does not seem any special reason why words like 'adsorption', 'aerosol', 'molecule', and 'osmotic pressure' should be termed 'chemical' rather than 'physical'; but classifications are always fallible, and like speculative hypotheses, must be scrapped when they are out of date. Among the few omissions noted is the word 'chemotherapy', and agricultural terms in general, though a number of these occur under 'botany'. On the other hand, the inclusion of a large number of medical terms comes as a welcome surprise.

The success of this book is due to the excellent work of a large team of scientific contributors (whose names are not, for the most part, well known), and to the judgment of the two editors; to them for their ability, and to the publishers for their enterprise, the thanks of the scientific and technical world will be readily given. E. H. T.

Volumetric and Phase Behavior of Hydrocarbons

By Prof. Bruce H. Sage and Prof. William N. Lacey. (Associated with Research Project 37 of the American Petroleum Institute.) Pp. xii+299. (Stanford University, Calif.: Stanford University Press; London: Oxford University Press, 1939.) 28*s.* net.

THIS book is mainly concerned with physico-chemical principles affecting petroleum technology. It begins with some mathematical and thermodynamic principles, then deals with one, two, and multi-component systems largely from the experimental point of view, the text being illustrated by many clear diagrams. There are references to recent literature. The phase rule and thermodynamics are really the basis of the treatment, but the correlation of experimental data is what is emphasized throughout. When quantitative knowledge of the physico-chemical properties is available it is introduced. The section on multi-component systems should be particularly interesting to the petroleum specialist. An appendix deals with retrograde condensation.

The book is a courageous and successful attempt to introduce the principles of chemical thermodynamics into a region of technical application where they can be of real importance and significance. In recent years much work has been done on the physico-chemical properties of the individual hydrocarbons, and a book of this character will help in pointing out its significance to the technologist.

Chiltern Country

By H. J. Massingham. (The Face of Britain Series.) Pp. viii+120+66 plates. (London: B. T. Batsford, Ltd., 1940.) 8*s.* 6*d.* net.

English Lakeland

By Doreen Wallace. (The Face of Britain Series.) Pp. viii+120+66 plates. (London: B. T. Batsford, Ltd., 1940.) 8*s.* 6*d.* net.

THESE books are the latest additions to the volumes in the series entitled "The Face of Britain". Numerous photographs of the two districts dealt with have been collected, and excellently reproduced. If selection be the criterion of art, almost every one of these photographs is a work of art, for they show both the diligence and the good taste needed for rightly directing the camera, the wide angle of which makes it difficult to exclude inharmonious objects.

Mr. Massingham describes the Chiltern country with a wealth of detail, both in relation to natural features and rural industries (such as chair-making and "bodger" work), which still, fortunately, survive in the beech wood districts. Attractive comments are made on rural architecture, as, for example, in describing the outside chimney of the cottage "reaching its brick stack up from tiled shoulders".

The first chapter of Doreen Wallace's volume on "English Lakeland" is appropriately entitled "Tourists' Paradise". The author writes with more intimate knowledge than that of a tourist, having been born and brought up in the district. The well-informed account of sheep farming on the fells provides a true picture of the relation of life and landscape which is such an important element in the æsthetics of scenery.

With reference to the opinions of the author on the appreciation of Lakeland scenery, there is one point in which we feel bound to record disagreement. We are told, p. 11, that "Wordsworth had the woolly mind of the truly good". His "Guide Through the English Lakes", so far from being evidence of a "woolly mind", is one of the clearest and most accurate analyses of natural scenery that has ever been written.

HENRY E. ARMSTRONG*

By Dr. E. F. Armstrong, F.R.S.

MY father was essentially artistic in temperament and had a fine sensitivity for many forms of art. Thus he had an ear for and enjoyed music, he derived much enjoyment from his black-and-white pictures, and took an interest in modern pottery. He was unable to take a symphony to pieces, to talk of good and bad construction in composition, or to argue about schools of painting; but people who do understand these things are often bores and hypocrites of the first order. A good "companion in music" of his writes: "times out of number I have sat with him on the hardest seats imaginable in order that we should go to three concerts in misery rather than to one in comfort. The dear old man was hypnotized by Wagner and Haydn, Beethoven and Mozart, but could not say why—and thank God for it. Your father's appreciation of the arts was, I think, that of the true Artist: underneath the man who possessed a scientific approach to most things lay the makings of a great Artist."

He had an intense worship for colour either in Nature, on textiles, or elsewhere. Some association of eye effect with the chemical problem of origin gave him a feeling of physical well-being when he viewed a real patch of colour. Some of his happiest days were those spent among the autumn colours, and he wrote with deep feeling about them. His palate was particularly sensitive, especially in later years, to flavour and odour, gifts which led him to find keen enjoyment in fine wines and good food. He never smoked and hated the smell of tobacco except from the best cigars, and in consequence perhaps had a palate of extreme delicacy. In all these matters he was always ready to be educated and acquired much knowledge of the "bitten line" through my collection of etchings, and of wines of virtue through André Simon, greatest and most genial of good companions. It might be said he had a nature abundant in resource which found every moment full of charm. He never let himself be cabined, cribbed, or confined. This wide range of interests often prevented him from completing a piece of work undertaken with enthusiasm, new problems diverting his attention. He set himself a high standard in his writing and would not allow publication until he was satisfied with the final draft.

He definitely lacked the engineer's mentality and the appreciation of what the engineer does. Perhaps for this reason he was never in close association with his colleague, Unwin, and other leaders of engineering. He tried hard to put the ideal of science and the detective method of scientific inquiry before many generations of engineering students at an age when perhaps they were least receptive of aught else but the practical side of engineering, and perhaps in consequence of failure to interest the many became biased against the engineering mentality.

The students of the Chemical Department at the Central Technical College were few in number, but they made up in quality for any lack of quantity. Practically all of them came to the front in their chosen paths; they were forced to do so by the Professor who admonished them when necessary for their own good. In his day he had a greater personal influence on his men both at College and after leaving than any other professor. He was rewarded when at one period his ex-students or staff held so many of the chairs of chemistry; for example, Wynne, Kipping, Pope, Lapworth, Lowry, Forster, Philip, Crompton, and Percival in Great Britain, and Worley in New Zealand, whilst E. M. Rich became chief education officer to the London County Council.

There exists a list of the careers of his old students showing the many branches of industry into which they have penetrated. Most of them have left their mark on their particular industry either by discovery or by rising to high positions in it, and one is inclined to wonder, after studying it, what would have been the position of chemical industry in Great Britain prior to 1914 if Armstrong had chosen the other path at Finsbury and created there a great school of training for the chemical industries.

It is important to emphasize my father's personal interest in his students, both when at college and throughout their careers. He took the greatest pride in their achievements and worked unceasingly for their promotion. Apart from those he actually taught, there were perhaps quite as many chemists who discussed their researches with him and received much help and guidance, often daily letters, coupled with the frankest criticism. Many others, again, came for advice regarding their careers. His enthusiasm for those who accomplished anything knew no bounds and he threw all his influence behind them. One recalls, for example, a shy schoolmaster, H. B. Baker, working on the reactions of dried gases. His brilliant

* Part of the first Armstrong Memorial Lecture of the Society of Chemical Industry, delivered on February 3.

career is well known. My father's correspondence contains a large number of highly appreciative letters from distinguished men, often written on the occasion of their election to the Royal Society.

Armstrong made a point of knowing everybody in chemistry and as many as he could in other sciences; he specially encouraged the younger men and liked them to make the pilgrimage to his house at Lewisham on Sunday. There are many letters testifying to the influence he had on these afternoons. After tea he used to encourage them to talk about their work, and often late in the evening he would write them some suggestions to overcome their difficulties.

Armstrong had a great capacity for making friends and, what is rarer, of continuing to make new friends in advancing years; they had to be men of independent thought. He had the trait of hero worship in his make-up; all his life he worshipped his teachers Frankland and Kolbe and his friend Dewar, and he had the utmost admiration for many other of his friends; this was particularly brought out in his obituary notices, which were models of graceful feeling. He wrote in reference to Ellwood Hendrick—"A friend cannot be defined. He is never made: he comes, when and how who shall say? Only where the wind listeth. He is the greatest and rarest of discoveries: the inestimable loss." Of such quality was the friendship with Dewar, Messel, W. H. Perkin, senr., the Browns, Horace and Adrian.

My father always felt he owed much to the very remarkable scientific quartette at Burton-on-Trent—Peter Griess, Cornelius O'Sullivan and the Browns—all active in the scientific service of brewing. The achievements and influence of these four men on chemical science have been profound. Armstrong has done full justice to it—"They sought neither gain nor applause; love of their art was their guiding light; they were led solely by desire to explore its fields, to grasp its value, to display its beauties."

He frequently went to Burton and corresponded closely with his friends; the introduction to brewing gave him a life interest in this subject, with which he maintained close contact all his life. He pleased to be a good-humoured critic of the quality both of the product and of the science put into it on diverse occasions, and had many friends in the industry. I myself was at one time destined for Burton, but Fate turned my path to biscuits instead of beer.

As a young man my father was extremely earnest and unsociable; my mother had the greatest difficulty in getting him to go anywhere; he paid only a very few calls on Sunday mornings to old family friends. His whole life was devoted to his work at the College, to teaching and research and to affairs of the Chemical Society. When he came home he wrote letters until late into the night. It was much later in life that he allowed the latent social side to develop, when he had leisure to go about and meet people.

My father shone also as a host; the formal dinner parties at Lewisham were in the true Victorian style, with Clarke, the laboratory attendant, called in as a waiter. The guests were most carefully paired and many interesting people came to the house. One such party included Sir George Robertson, the hero of Chitral, and Prince Kropotkin, then a prominent Russian revolutionary, though to-day his politics would be considered the palest of pink. We had no cellar book like Saintsbury, but a visitors' book was maintained from 1894 and in time it became an honour to be included in it. It is truly international; every American or German chemist who came to London made the journey to Granville Park, generally on a Sunday, and the names of few of the British chemists of the day are missing. A frequent entry is that of Joji Sakurai. His is the last name in the book; he called on May 21, 1937, when my father was confined to his room. My sister tells me that at 3 o'clock in the afternoon a half bottle of champagne was sent for so that the two old gentlemen might drink to one another. Sakurai passed away on January 28, 1939.

In his later years Armstrong became the guest *par excellence*. Adorned with his coloured waistcoats, his one personal vanity, though he claimed them as an advertisement for the achievements of the dye industry, he became a much-sought table companion at the dinners of the Omar Khayyam Club, the Saintsbury Club, the Wine and Food Society and many similar occasions; he enjoyed also the banquets of the London Livery Companies. His knowledge was so wide, his range of subjects so varied, his views so original and outspoken that they aroused the interest of his table companions. Very often correspondence and friendships followed these chance meetings.

One dining club merits special mention, namely, the original Chemical Club, which was an exclusive body, limited to forty chemists elected by ballot; it met monthly on the same days as the Chemical Society. Formed in November, 1872, the first secretary was Pedler, but Armstrong took on the task in the following February and continued to perform it for many years until the constitution changed and the dining club became associated with the Council of the Society. The history of most dining clubs is much the same. They either become too formal and dull and so lapse, or they depend on the enthusiasm of one man and a set

of regular participants. The old Chemical Club took the latter path; it became entirely informal, minutes, rules and subscriptions were in abeyance and it relied on Armstrong, or rather Mrs. Armstrong, to send out the monthly cards and order the dinners. Here the older men were met on level terms by the younger, and many enduring friendships were formed. Here also it was possible to entertain appropriately distinguished foreign visitors to our shores.

My father took delight also, when the Chemical Dining Club was no more, in arranging dinners at the Athenæum and elsewhere to distinguished visitors to London, when representative Londoners widely chosen were gathered to meet them.

The successor to the Chemical Club has been the Catalysts, now also a mature body. Armstrong was seldom absent from these dinners and did much to make them enjoyable. He was a regular chairman also at the monthly lunch meetings of the Old Centralians, a gathering which gave him lively satisfaction.

"He that enlarges his curiosity after the works of nature demonstrably multiplies the inlets to happiness."—Johnson, Rambler No. 5.

Academic life gave my father full opportunity for holidays, and he enjoyed the absence from London. He enjoyed walking and continued it into the 'eighties and would have no other sport. I remember Lockyer trying to get him to take up golf on Blackheath. A regular Sunday morning walk across Blackheath to the Observatory in Greenwich Park will always be associated by me with his memory.

In his early youth he walked a good deal in Scotland; later he went abroad to Switzerland and Norway, then just opening up for tourists, often in company with Tilden or Clowes.

For the family holidays which played so large a part in his life, Margate was at first the chosen place. Here he had Lauder-Brunton and Hardy, the eye specialist, among others, to see; Lockyer was at Westgate. In later years the geological general practitioner Dr. Arthur Rowe was his great friend there. We were taught at an early age to walk; to study the changes in the soft chalk, in that district very rapid; to look for fossils; to visit churches and to learn the history of the Roman occupation and of the Cinque Ports.

Beginning about 1886, Lyme Regis was chosen for Easter. The Tildens came too, also Wynne; Lord Lister lived at the top of the hill. By that time we youngsters could walk farther, but even so the ascent of Golden Cap was a feat, and more than one visitor found the two miles or more of shingle along the face of the intervening hill enough for that holiday.

A visit of the Geologists' Association took us to Swanage one Easter (1895) and there and then the cottage on the pier was secured for the summer and for many future holidays. Here the family was trained in nature study—to collect, to observe, to record as part of a normal enjoyable holiday. One of his children should have become a biologist, nurtured under such environment, but heredity or some other factor proved too much for us and we have remained normal people taking perhaps a special interest in our holidays and collecting as a hobby. The Isle of Purbeck is still a unique centre for study with three geological ages in juxtaposition, involving three different flora and fauna. My father gave much time to his coastal photography here; it involved carrying around a heavy camera, tripod and glass plates, and sundry adventures by way of trespass or in boats to secure pictures of selected sections.

We had the ambition to walk round the English coast on the coastguards' path and in course of time accomplished all the worth-while sections, writing up the experiences in the form of illustrated and annotated log books. We were induced in this way to look up the history or other information relating to places and objects, and so learnt at an early age how to consult books of reference and make a précis of information. This training was of the utmost value; it helped to teach us to learn easily anything which appeared of interest, though we were as stubborn as other children in refusing to learn the dull stuff taught at school. None of us was high in class except in our pet subjects which we mastered with ease.

The transference of affection to the Lake District came later, the introduction being effected on a Geologists' Association trip led by Marr. Here Armstrong had his happiest days and he returned to Manesty Farm near Grange, with its unique views into the jaws of Borrowdale in the one direction and across Derwentwater to Skiddaw and Saddleback in the other, as often as possible each year for many years. Long walks were carefully chosen to give variety and interest, and formed a programme of increasing severity to suit all weather conditions. Some of the most arduous gave him greatest joy; the long grind round to the top of Grasmoor, the attack on Gable from Green Gable via the side of the slate quarry on Honister, the walk up Ennerdale and the climb out at the head of the valley, the ascent from Seathwaite to below Great End and the climb up Cust Gulley were some of his favourites. Another was the ridge walk to Causey Pike followed by an abrupt descent that often caused havoc to his companions, in which he took secret delight. The use of a car to lessen road distances and make new walks possible in later years added greatly to his enjoyment.

He loved having visitors at Manesty, and very many came there; he would talk freely on the hills and in the sitting room on slack or wet days and gave mental stimulus, as only he knew how, to not a few. He made friends with the parson, Canon Rawnsley, at Keswick, and took an active part in all the fights to preserve the Lake District against vandalism. The greatest joys of all to him were the days when the snow came and gave yet one more touch to the kaleidoscope of colour on rock and hillside. Those who knew him in the hills perhaps saw him at his best and most versatile —a philosopher, wise in very varied knowledge, more full of zeal than tolerance, perhaps, putting the cause above worldly ambition.

Armstrong was strongly individualistic and gloried in being so; in his later years he enjoyed being provocative and exaggerated his attacks—in his own words—"there is more fun in laying about you." As a freelance without occupation he had not often the opportunity to be constructive. In a wiser age perhaps his abilities would have been more utilized.

It must be remembered that he was the product of an age when transport was slow and communication limited—the horse and buggy days of our American cousins. Whereas there were then many small local worlds, to-day there is only one large world in which the radio brings an event to the notice of everyone within a few seconds of its happening. Science and philosophy to-day more than ever seek to submerge the particular in the universal; there is little room for the unique individual, who is looked on as irrational. The desire of the human mind is for unification; all that is, was, or ever shall be, originates from one source. Most students to-day accept this view as a doctrine of scientific faith and regard one who combats it as outside reason. Hence perhaps the failure of the youngest generation to appreciate Armstrong's greatness. Had he lived fifty years earlier he would have been venerated for the very reason that he had been criticized. Hence the fact that his outpourings in scientific journals were most appreciated by older men and in the United States, which is still largely individualistic.

As an adventurer Armstrong could not understand the satisfaction to be gained from committees and conferences. Immediate action appealed to him; the need of the cause was too urgent to allow time in which to placate the opposition. It has been said that disapproval occupies the greater part of our conversation; it is tempting to say how a job ought to be done when one is denied the opportunity to do it.

Progress, educational or otherwise, means hard fighting not for one lifetime only but for generations. Those whom Priestley termed "the men who will never learn" are strong. Meredith's simile of the hair, in that remarkable work the "The Shaving of Shagpat", as illustrative of the errors, injustices, or illusions which an enormous effort is required to destroy, appealed very much to my father. His ideals were those for which we are fighting to-day. To him they were clear and patent. In an address in 1935 to the Frankland Lancastrian Society he wrote, "as human beings most of us are only interested in ourselves. We have to learn without delay how much more we might, could, and should do for ourselves." He outlined some of the immediate needs of the nation and emphasized how the inquiry will demand an extraordinary use of intelligence which in large measure will have to be developed for the purpose. We are trying to do these very things in 1940–41, under difficulties of which "the hair" is the greatest.

My father was a great reader. Probably no one knew the chemical literature up to a certain period better than he did and he possessed a most retentive memory. In later years with more leisure he read very widely. He appreciated that "the worth of reading is in its after effects; it forces big thoughts and compels the recognition of new aspects of common things." His writings are full of quotations, Lewis Carroll being one of his favourite authors for this purpose.

He mentions the influence of Trench's book "The Study of Words" on his youthful impressions and his then habit of omnivorous reading. He gladly returned to this when he gave up his professorship. The influence of good companions is to be found in his later writings, which were often brilliant apart from their pungency.

Some words of Lafcadio Hearn are, I think, appropriate to him, namely, that if a man has a very powerful imagination as well as a very large sympathy the study of science alone will give him everything he needs. "He can get the water of emotion out of any desert of dry facts." Hearn says that such men are very rare, and students of science, who normally tend to be hard, are counselled to read emotional literature. I think it will be agreed that his addresses of later years are full of feeling; he took enormous pains with them.

My father had a wonderful old age; he found something to do every day, kind friends to encourage him and though his hearing began to fail, his vitality and mental energy were unabated. Only on the death of his wife in the last days of 1935 did ill-health overtake him. He bore a long period in his room with great patience and preserved his mental faculties to within a week of his passing on.

He accepted the creed of Ben Ezra, who so boldly declares that old age is better than youth simply because of its being the time of knowledge and understanding.

He has marked Browning's verse :

"Thoughts hardly to be packed
Into a narrow act,
Fancies that broke through language and escaped
All I could never be
All men ignored in me
This I was worth to God, whose wheel the pitcher shaped."

He hoped much from heredity and believed the best qualities of a man may appear in his grandchildren or great grandchildren ; they furnish the proof of the worth of the ancestor, using the words of Lafcadio Hearn. The tragic death of his grandson, Kenneth Frankland Armstrong, in whose career H. E. A. took so much pride, was perhaps the greatest blow of his life.

I have sought to trace the life-history of a versatile, individualistic man ; one who kept himself fit in body and also in mind ; one who gave unstintingly of his best to many causes without thought of fame or honour for himself ; it was indeed his nature to decline all such. If the task has been achieved we have seen what is so well expressed in the words of Walt Whitman :

"Journeyers gaily with their own youth,
Journeyers with their bearded and well-grained manhood,
Journeyers with their own sublime old age :
Old age, calm expanded, broad with the haughty breadth of the universe."

'WORKING-CLASS' EARNINGS AND EXPENDITURE

By D. Caradog Jones,

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Definition of 'Cost of Living'

THE nominal wages of a working man are in the main governed by the demand for and the supply of such skill as he possesses. His real wages—what he can buy with his money—depend upon the movement of prices. During a war, the mounting cost of living invariably directs public attention to the need for regulating wages so that real and nominal shall keep step. The 'Cost of Living' Index was designed for this purpose in 1914 and has been widely used ever since.

'Living' clearly has a very different meaning in different social circles, so that changes in the cost of living of different classes cannot be accurately measured with the same instrument. Agreement must accordingly be reached upon a standard, a definition of living, if we are to measure its changing cost. The purpose of the Ministry of Labour Index is to measure the average increase in the cost of maintaining unchanged a standard of living of the working-classes as defined in 1914. Strictly, therefore, this index is a measure of price changes—the mean change in price of an aggregate of certain specified commodities the enjoyment of which constitutes 'living'. The choice of these commodities was based on an analysis of 1944 urban working-class family budgets collected by the Board of Trade in 1904, but between 1904 and 1914 the Sumner Cost of Living Committee (1918) reported that "no considerable changes took place in the mode or standard of living". These budgets indicated that, in spite of a wide divergence in expenditure between families, certain needs are common to them all. These basic needs alone, things which from time to time practically every family buys, are used to define living. The number included in the 1914 calculations was severely limited ; the list of foods, for example, contained only fourteen commodities : no fruit and no vegetables, except potatoes, were included. In such respects the standard of living of the working-classes has risen considerably since the War of 1914–18 ; to this improvement the cultivation of allotments, advance in the science of preserving and storing food, quicker transport from abroad have all contributed. Consequently, an analysis of household budgets to-day reveals a marked extension of the field of basic expenditure.

New Collection of Household Budgets

The first results of the recent and most elaborate budget inquiry ever undertaken in Great Britain by a Government department were published in the *Ministry of Labour Gazette*, December 1940. The households invited to keep budgets—and encouraged to do so by a small payment for each

approved budget—were determined by a purely random choice of names from the registers of adult workers insured against unemployment, all districts throughout the United Kingdom being adequately represented. Certain important classes of non-insured workers were also included, but applicants for unemployment assistance (that is, long-standing cases of unemployment) were excluded. With this reservation the households represented may be described as those of manual workers, and non-manual earners of salaries up to £5 a week engaged in industrial, commercial or clerical occupations. Agricultural workers do not concern us in this article. In Great Britain alone, 31,000 households were visited; about 9,000 proved to be outside the scope of the inquiry or were ruled out for some other good reason; of the remainder, nearly 60 per cent co-operated. So high a return in this type of investigation exceeded expectations. It reflects great credit on the Statistical Division of the Ministry of Labour directing it, on the employment exchanges and advisory committees throughout the country, and on the thousands of voluntary workers who formed the direct link with the families visited. The majority of these families kept a satisfactory record of expenditure for four specified weeks, in October 1937, and in January, April, and July, 1938. We may confine our attention to these 8905 households, since the addition of budgets kept for a shorter period makes no significant difference in the figures.

Mean Size of Household and Accommodation

The information so far available from these new budgets is best summarized in the form of averages. Thus, the average budget family was composed of 3¾ persons, including 2¼ adults over eighteen years of age and one child under fourteen. Two persons per family were dependants and the earners worked on the average five days a week. Two per cent of the families—mostly miners—lived rent free in dwellings provided by their employers; nearly 18 per cent either owned or were buying their houses; the remaining 80 per cent paid rent and the mean number of rooms occupied was 3·9. The average weekly rent (including rates and cost of purchase when relevant) was 10*s*. 10*d*.

Expenditure

The average weekly expenditure per family on food was 34*s*. 1*d*. Of this, 10*s*. was allocated to meat (including bacon, fish, etc.), 9*s*. to dairy produce, 5*s*. to bread, flour and cakes. The mean consumption of meat and bacon per family was nearly 6 lb. each week, of butter and margarine 2½ lb., of sugar 4¾ lb., of eggs two a day. The average consumption of bread and of potatoes by each person was just over ½ lb. a day, while that of milk was appreciably less than ½ pint a day. The change in distribution of expenditure as compared with 1914 and the trend towards middle-class expenditure, as revealed in the accompanying table, is of particular interest.

Proportional distribution of expenditure on food.

Expenditure on	Working-class budgets		A middle-class sample
	1914* %	1937–1938 %	1926* %
Meat, fish, etc.	32·0	31·2	37·5
Bread, flour, cakes	19·3	15·7	12·2
Dairy produce	22·3	27·9	25·9
Vegetables, fruit	9·7	13·3	13·2
Sugar, jam	7·5	5·1	5·1
Tea, coffee, cocoa	6·6	5·8	4·6
Oatmeal, rice, etc.	2·5	1·0	1·5

* Derived from an article by D. Caradog Jones (*J. Roy. Statistical Soc.*, **91**, Pt. 4, Table xiii).

The weekly consumption of coal amounted on the average to 1¾ cwt. for each family, the expenditure on fuel and light together being 6*s*. 5*d*. a week. Out of the 8905 households who kept satisfactory budgets of their total expenditure for four weeks, 2100 were persuaded to keep a detailed record of what they spent on clothing and footwear for twelve months. On this additional and more reliable evidence the total average expenditure on clothing is estimated at 8*s*. 1*d*. a week per family.

Distribution of total expenditure.

Expenditure on	Working class			A middle-class sample
	1937–38	1914*	1937–38	1926*
(1)	(2)	(3)	(4)	(5)
	s. d.	%	%	%
Food	34 1	60	40	32
Rent and rates	10 10	16	13	14½
Clothing	8 1	12	9½	11
Fuel and light	6 5	8	7½	4½
Miscellaneous	25 7	4	30	38
Total	85 0	100	100	100

* *J. Roy. Statistical Soc.*, **91**, Pt. 4, Table xii.

Acting on the principle of including in the calculation of the Cost of Living Index only basic needs, the Ministry of Labour has hitherto given very small weight to expenditure on items other than the four main groups already considered. Their miscellaneous group included only such cleaning materials as soap and soda; domestic ironmongery, brushware and pottery; tobacco and cigarettes; fares; and newspapers. These items between them account in the new budgets for an expenditure of 7*s*. 4*d*. a week on the average. But in addition, these budgets include compulsory national insurance, costing 2*s*. 1*d*. per family, while voluntary insurance premiums and trade union subscriptions together amount to 3*s*. 9*d*.,

whereas the total average expenditure on all items in the miscellaneous group is 25*s.* 7*d.* The difference is made up of house furnishings (2*s.* 7*d.*), entertainment (1*s.* 4½*d.*), hospital, medical and dental charges (1*s.* 8*d.*) and other expenses.

The ultimate result of this analysis of present-day expenditure is summarized in columns 2 and 4 of the accompanying table, and again comparison is made with working-class expenditure in 1914 and middle-class expenditure in 1926, bringing out as before the closer approach of the working-class towards the middle-class type of distribution.

Effect of New Weighting on Cost of Living Index

What difference would the use of the new weights shown in column 4 above make in the Cost of Living Index? To answer this question we must understand precisely what it means. Suppose we wish to compare costs at two given dates, July 1914 and the period 1937–38 to which the new budgets relate. The index at present in use measures the increase in the cost of maintaining unchanged the 1914 standard of living as already defined. There is only one correct way of doing this, and the answer is given month by month in the *Ministry of Labour Gazette*. If we calculate the mean of the official price indexes at the four dates nearest to the budget weeks, we find that food had risen 42 per cent, rent and rates 59½, clothing 110, fuel and light 80½, and the miscellaneous group 75 per cent between July 1914 and 1937–38. Each of these percentages, *by definition*, must be weighted according to its importance as judged by the average proportional expenditure upon the corresponding group in July 1914. In other words, the appropriate weights are those given in column 3 of the accompanying table. This leads to the conclusion that the cost in 1937–38 of 'living' as defined in 1914, was 57 per cent above the 1914 level.

But suppose we change our standard and proceed to compare with this figure the 1914 cost of buying the commodities which constituted 'living' as defined by the average of the 1937–38 budgets. We start now with the distribution of expenditure shown in columns 2 and 4 of the table. To find the cost of this average budget in July 1914 we must allow for the mean change in price of each of the five groups between 1914 and 1937–38 given above. This done, we find that the budget which cost 85*s.* in 1937–38 would have cost only 52*s.* 9*d.* in 1914. In other words, the average budget of 1937–38 cost 61 per cent more at that period than it would have cost in July 1914. If, therefore, we wish to define 'living' according to the present-day standard in place of that of 1914, the result will be a rise in the 'cost of living' from 100 to 161 instead of 100 to 157. It may be presumed that this difference is much less than the critics of the old Cost of Living Index anticipated. It illustrates the validity of the statistical principle that the weighting of price movements—normally based on a selected standard of living—is of less importance than the price movements themselves, which are independent of the particular standard selected and determined afresh each month.

Relation of Earnings to Expenditure

One further question of interest remains. How is the average standard of living, represented by these budgets, related to the present-day level of earnings? To answer this question use can be made of data given in the November and December issues of the *Ministry of Labour Gazette* 1940, concerning average earnings in the principal industries at July 1940. Agriculture and mining are two notable omissions from the industries listed, but it is reasonable to omit them as we are only concerned with urban budgets. It will be appropriate also to confine our attention to men's earnings in dealing with household expenditure; and in order to obtain a composite average it will suffice to weight the earnings in different industries by the number of occupied males, aged 14+, in each as given by the 1931 Census for England and Wales. The resulting average of weekly earnings is 87*s.* It should be added that under war conditions two industrial groups, by reason of the numbers employed, have a predominating influence in producing this result, namely, the metal, engineering, and shipbuilding group and the transport and storage group. Another point to be noted is that average wage rates would, of course, be at a distinctly lower level. We have also information, in the same two issues of the *Labour Gazette*, as to the percentage increase in men's average earnings for each of the same industries since October 1938, a date more closely approximating to the budgets period. By weighting these as before it may be estimated in round numbers that average earnings in October 1938, for these combined industrial groups, were in the neighbourhood of 70*s.* a week. Bearing in mind that on the average there were 1·75 earners per household, this would give an ample margin to meet a weekly family expenditure of 85*s.*, even allowing for the probability that all earnings do not go towards housekeeping.

Averages, useful as they are, do not bring out the light and shadow in the picture. If we could be also told what the budgets reveal as to range of spending, we should have fairly accurate and unique information as to the relative poverty and wealth of a large section of the population.

THE BANANA IN CENTRAL AMERICA

III. PANAMA DISEASE

By PROF. C. W. WARDLAW,
UNIVERSITY OF MANCHESTER

DURING recent years in Jamaica and Central America, the spread and intensification of leaf disease of bananas, *Cercospora musæ*, Zimm., has tended to deflect public attention from another epidemic disease of long standing and of great economic importance, namely, Panama or wilt disease, caused by the soil-borne fungus, *Fusarium oxysporum cubense*. To-day the question is often asked as to which of the two diseases presents the greater danger to the industry. During 1935–40, an observer, surveying the almost incredible damage wrought by leaf disease in such a brief space of time, and aware of the much slower spread of wilt disease, might well have been tempted to regard the former as the greater evil, assuming that he did not take refuge, as Sir Roger de Coverley almost certainly would have done in the circumstances, in the view that there was much to be said on both sides. Among the more enlightened members of the planting community, however, the opinion is held that wilt disease is the more serious problem since leaf disease can be, and is being, controlled, whereas wilt disease can not. From the investigational point of view, leaf disease, while not a simple problem, nevertheless is not beset with those complications which are inseparable from the activities of soil pathogens, and whereas it is known that bananas resistant to wilt disease can be obtained by hybridization, the work is slow because of technical difficulties. So far, indeed, no hybrid has been obtained which possesses the many qualities which have made the Gros Michel the commercial banana *par excellence*. Moreover, it is apparent that some considerable time must elapse before such a hybrid is produced. In some respects, therefore, the Panama disease situation remains very much what it has been for many years. The disease, of course, has continued to spread and has led to the discontinuation of banana growing in many areas.

The passage of time has not lessened the many curious and unexplained aspects of Panama disease. Some instances may be cited. Perhaps one of the most surprising situations is to be found on the lower Ulua River in the Republic of Honduras, where, notwithstanding periodic inundations by flood water carrying debris from affected areas higher up, large areas have remained in a high state of production, with a negligible amount of wilt disease, for a period assessed at fifty years. By contrast, areas inland from La Ceiba have been seriously affected by disease within two years of planting. There, the evidence is suggestive of a pre-cultivation dispersal of the pathogen during the periodic flooding of the forests adjacent to the river, wilt disease having been observed in areas scoured by the flood water higher up. On being planted with bananas, such areas have rapidly gone out with disease. Many instances are known of the 'resistance' of older areas and the 'susceptibility' of new. Whether conditions on the floor of virgin forests are specially favourable for the propagation and distribution of *F. cubense* has not, so far as I am aware, been investigated in detail, but the evidence strongly suggests that they are.

A particularly obscure problem is presented in certain areas which for many years have appeared to possess 'resistance' to the disease but which suddenly begin to be seriously affected. Dispersal of the pathogen by flood water is not involved, and so far the nature of the factor which is operative has not been ascertained. An increase in the pathogen population doubtless bears a direct relation to the increasing incidence of the disease, but relevant data are scanty or absent.

On the controversial question as to whether fresh outbreaks are principally due to contact with neighbouring diseased plants or are the result of new sporadic infections, little can be added save that numerous instances of both abound in those areas where the disease is making headway. It has been observed that spread by contact takes place more rapidly in some soils than in others: the more open the texture and the more acid the soil, the more rapid is the spread of disease. Alternatively, clay soils and slightly alkaline soils appear to possess more 'resistance' to the disease. This information has now been available for some years[1], and recent observations would seem to bear it out. On light riverside soils, for example, the spread of disease from foci of infection may be particularly rapid. Recent years have also shown that clay soils, for many years considered 'resistant', have eventually shown an even more rapid spread—a phenomenon for which no

adequate explanation has so far been forthcoming. Other areas are also known which, after many years in an almost disease-free state, are now becoming rapidly affected. The collective experience, practical and scientific, in Central America is that hydrogen ion concentration is the master factor determining the severity of Panama disease, followed by texture; but, as Reinking's work shows, distribution of the pathogen and density of its population in the soil obviously require careful consideration[2].

The Panama disease situation in Central America is being closely watched, and on the properties of the larger companies every effort is being made to check its spread and to test out any new idea which might eventually have some economic value. An unusually interesting and important experiment is in progress at the present time. This consists in flood-fallowing an area of about a hundred acres which had previously been put out of production by Panama disease. The area has been empoldered and divided into four sections, each to be kept submerged for a different period of time. The maximum period of inundation will be eighteen months. This experiment is based on the facts that soil fungi such as *Fusarium cubense* require oxygen to live, and that, when highly infected soil was submerged for one month under two feet of water, no *F. cubense* could be found in it. The outcome of this experiment will be awaited with the greatest interest by all associated with the extensive alluvial banana lands of Central America. Already it has been found that in new land, built up by the sedimentation of controlled flood water, and therefore subjected to several inundations, the incidence of Panama disease has been negligible. This may be considered as an indication of the probable success of flood-fallowing, but time alone will tell. A successful result will obviously have an important bearing on the whole question of banana production in the Caribbean.

[1] Wardlaw, "Diseases of the Banana", Chap. iii. Macmillan (1935).
[2] Reinking. Several papers summarized in (1) above.

OBITUARIES

Prof. G. Dawes Hicks, F.B.A.

THE loss of Prof. G. Dawes Hicks, on February 16, at the age of seventy-eight, will be felt, not only by the wide circle of his personal acquaintance, but also by all who have at heart the interest of philosophy in Great Britain. Friends and students will cherish the memory of his kindly and affectionate nature, his simplicity of heart, his unfailing courtesy, the generous hospitality of his house and table, and his readiness to place his store of learning and the rich resources of his library at the disposal of all students of the problems that engrossed his life. They will not easily forget the short spare figure of the teacher whose frail appearance veiled an iron constitution, that enabled him to excel as a climber and to carry out the duties of his London chair from his house in Cambridge with unabated efficiency. He was professor of philosophy in University College, London, during 1904–28, and lectured on psychology at Cambridge regularly. His energy both of body and mind was amazing. Even when stricken with illness and the sorrow of his wife's death his high courage never failed him; in his last three years he published his Hibbert Lectures on the "Philosophical Basis of Theism" and a volume of noteworthy essays, and persisted in his work as sub-editor of the *Hibbert Journal* from his sick-bed to the very end. He had been largely responsible for founding the *Journal* in 1901–2.

Hicks loved philosophical discussion, whether by his own fireside or at public gatherings, such as those of the Aristotelian Society and the Mind Association. He was secretary of the Aristotelian Society for many years, and its president in 1913. When he spoke it was with lucidity and precision, voicing definite convictions uncompromisingly but with singular modesty. No one could fail to be impressed by his fairness in controversy, his intellectual integrity, and the distinction of mind that lay behind his quiet measured utterances. It was the same with his writings. Disdaining all artifices of style or appeals for popularity, he wrote as a philosopher for fellow-philosophers, so that his books were scarcely calculated to rouse attention outside the academic boundary. They were caviare to the general; though his study of Berkeley, in the "Leaders of Philosophy" series, forms the best introduction to that thinker in the language, and the addresses delivered annually as a labour of love at the Carmarthen College, published in 1928 under the title "Ways towards the Spiritual Life", have a charm that goes straight to the reader's heart. It can truly be said of him that he wrote nothing that does not repay the reading.

Hicks was before all things a critical thinker, in the true Kantian sense; throughout his life he kept himself pure from the extremes either of scepticism or of dogmatism. He was very learned, recalling in his chosen way of life the *Gelehrter* of a now almost forgotten Germany rather than the normal type (if such there be) of an English university professor. But for all his scholarship he remained master of his own mind, and his thought was always on the move. To the end he was faithful to the example of his first great teacher, Robert Adamson. His studies at

Oxford and in Germany led him by way of Neo-Kantism to an idealist position akin to that of Bradley, and thence to the *via media* on which he took a firm stand during the last twenty years of his life, and to which he gave the appropriate name of 'Critical Realism'. The problems that most engaged his mind were in the fields of theory of knowledge and the philosophy of religion. His realism, evidenced in the refusal to allow any "bifurcation of Nature", was, in many respects, akin to that of Whitehead. Why, he kept asking, should not the grass be really green? He contended resolutely against the naturalistic fallacy of treating the knowing subject as an object among other objects. Perhaps his most characteristic doctrine was the threefold distinction that he discerned, alike in perceptual and conceptual thinking, between the activity of apprehension, the content apprehended, and the apprehended object; a distinction by which he endeavoured, in a manner reminiscent of the scholastic distinction of the *id quod concipitur* (the object) from the *id quo concipitur* (the concept), to escape both the Scylla of naïve realism and the Charybdis of representative perception.

In religion Hicks was all his life a member of the Unitarian communion, in which he had in earlier years exercised the ministry, from 1897 until 1903, at Unity Church, Islington. In his Hibbert Lectures he set himself to expound the rational grounds for his strong theistic faith. The strength of the book lies in its massive presentation of the cosmological, teleological, and moral arguments as a correlated sequence of evidence to a God, who is at once distinguishable from the Absolute of monistic idealism and subject, on epistemological grounds to temporal succession. The weakness lies in the author's evident lack of sympathy with any form of mysticism and in his disparagement of the evidence from religious experience. The thought of man's relation to God as that of a subject to a *subject* seems scarcely to have crossed his mind.

That Hicks left no finished system of philosophy was doubtless due in part to his lack of speculative imagination. He cannot be ranked with thinkers like Bradley, Alexander or Dr. Whitehead. But he threw much light—a dry light, as befits a philosopher—on many of the most important problems of modern thought. In early days, for example, he had studied psychology and psycho-physics under Wundt, Heinze, Volkelt and Hering, an interest that was fortified and deepened later through his friendship with James Ward. A striking essay on "The Dynamic Aspect of Nature" and another in criticism of Sir Arthur Eddington testify to his grasp of recent developments in physics. He gradually came to be recognized as one of the most competent and judicious thinkers of his generation; his old University of Manchester conferred on him a doctorate, and in 1927 he was elected a fellow of the British Academy. He will be long remembered with honour as a great scholar and teacher, a disinterested inquirer after speculative truth, and one of the most lovable of men.

W. G. DE BURGH.

Prof. C. R. Lanman

WE regret to record the death of Prof. C. R. Lanman, the distinguished authority on the ancient languages and culture of India, emeritus professor of Sanskrit in Harvard University, which took place at Boston on February 20 at the age of ninety.

Charles Rockwell Lanman was born at Norwich, Connecticut, on July 8, 1850. He graduated at Yale in 1871 and was awarded his Ph.D. in 1873 for his studies in Greek and Sanskrit. Further studies of Sanskrit and comparative philology followed during a period of four years spent at Berlin and Tübingen, where he was a student under the most distinguished authorities in these subjects of the day, among them Roth and Curtius. During 1876–80 he held an appointment as lecturer on Sanskrit at Johns Hopkins University, Baltimore, and was then elected to the chair of Sanskrit in Harvard University, which he occupied for fifty-six years. During his tenure, in 1889, he travelled extensively in India with the object of securing books in his subject for the library of his University. His tour was highly successful, the accessions he acquired numbering some thousand items including both books and manuscripts. In 1890 he delivered the Percy Trumbull Lectures at Johns Hopkins, his subject being Indian poetry, and lectured at the Lowell Institute, Boston, on Indian literature and early history.

Lanman was a fellow of the American Academy of Arts and Sciences and edited the *Transactions of the American Philological Association*, of which he was secretary and in 1890 president. He also edited the publications of the American Oriental Society for some years, serving successively as its corresponding secretary, vice-president and president, holding the latter office on two occasions, in 1907 and 1919.

In addition to his editorial activities, Lanman himself published a number of works on Sanskrit, including "Hindu Drama" (1900) and "The Beginnings of Hindu Pantheism" (1890). He was also responsible, in association with the leading Orientalists of the whole world, for the Harvard Oriental series, of which forty volumes have been published, containing editions of most of the classics of the ancient East. Among the numerous honours he received in recognition of his eminence in Oriental studies, was a gold medal on the occasion of the celebration in Japan of the 2,500th anniversary of the birth of the Buddha. He was a corresponding member of the British Academy.

WE regret to announce the following deaths:

Dr. C. R. M. F. Cruttwell, principal of Hertford College, Oxford, during 1930–39, on March 14, aged fifty-three.

Mr. J. P. Gilmour, editor of the *Pharmaceutical Journal* during 1916–33, on March 10, aged eighty.

Dr. E. L. Ince, lecturer in technical mathematics, University of Edinburgh, on March 16, aged forty-nine.

Prof. Mary S. Rose, professor of nutrition in Teachers College, Columbia University, on February 1, aged sixty-six.

NEW FELLOWS OF THE ROYAL SOCIETY

At the meeting of the Royal Society on March 20, the following new fellows were elected :

Prof. W. N. Benson, professor of geology, University of Otago, Dunedin, New Zealand ; distinguished for his contributions to the geology, petrology and physiography of Australia and New Zealand and in particular for his studies on the ultra-basic igneous rocks.

Dr. H. J. Bhabha, Reader in theoretical physics, Indian Institute of Science, Bangalore ; distinguished for his contributions to the understanding of cosmic ray phenomena, and to the fundamental theory of the elementary atomic particles.

Dr. E. C. Bullard, Smithson research fellow of the Royal Society ; distinguished for his work in geophysics and for the light which his work has thrown on the structure of the Great Rift Valley and on the rock floor deep under the surface in England and the surrounding seas.

Dr. C. D. Darlington, director of the John Innes Horticultural Institution, Merton, London, S.W.19 ; distinguished for his researches in cytology and cytogenetics.

Mr. P. I. Dee, university lecturer in physics, Cambridge ; distinguished for his experimental work in nuclear physics, in particular on atomic nuclear transformations produced artificially under bombardment by high-speed protons or deuterons.

Surgeon Rear-Admiral S. F. Dudley, C.B., O.B.E., medical director-general of the Navy (designate) ; medical officer in charge R.N. Hospital, Chatham ; formerly director of medical studies to the Royal Navy : distinguished for his work in epidemiology and bacteriology, especially in relation to the spread of diphtheria, influenza and meningitis.

Dr. J. C. Eccles, director of the Kanematsu Memorial Institute for Pathology in Sydney, formerly Rhodes scholar (Australia) and fellow of Magdalen College, Oxford ; distinguished for his physiological researches, which have dealt principally with excitation and transmission in the neuromuscular system.

Prof. H. W. Florey, professor of pathology in the University of Oxford, formerly Rhodes scholar (Australia), fellow of Gonville and Caius College, Cambridge, and professor of pathology, Sheffield ; distinguished for his work in general pathology, in particular on lacteals and lymphatics and on Brunner's glands. His work on 'lysozyme' has led to its isolation in a pure form.

Mr. A. A. Griffith, research engineer, Rolls-Royce Ltd., formerly Royal Aircraft Establishment, Farnborough ; distinguished for researches, ranging from pure physics to applied engineering, which have made notable contributions to the knowledge of strength of materials and to the science and development of aircraft and aero-engines.

Prof. H. W. Melville, professor of chemistry in the University of Aberdeen, formerly fellow of Trinity College, Cambridge ; distinguished for his outstanding contributions in the study of gaseous reactions and of the mechanism of polymerization.

Dr. J. Needham, reader in biochemistry in the University of Cambridge, and fellow of Gonville and Caius College ; distinguished for his application of biochemical methods to embryology, particularly in relation to the conditions determining embryonic and adult metabolism, and vertebrate development.

Sir David Rivett, deputy chairman and chief executive officer of the Australian Council for Scientific and Industrial Research, formerly Rhodes scholar (Australia) and professor of chemistry in the University of Melbourne. His scientific knowledge and leadership have been of great value to the Australian Commonwealth and the Empire.

Prof. Alexander Robertson, professor of organic chemistry in the University of Liverpool ; distinguished for his researches on the constitution of plant products, and particularly on the important insecticide rotenone.

Prof. T. G. Room, professor of mathematics in the University of Sydney ; distinguished for his work in geometry.

Mr. A. J. Rowledge, consultant engineer to Rolls-Royce, Ltd., formerly chief designer, D. Napier and Sons, Ltd. ; distinguished for innovations in the design and development of internal combustion engines for motor-vehicles and aircraft.

Dr. H. Scott, assistant keeper of entomology in the British Museum (Natural History) ; distinguished as a field naturalist and systematist. By prolonged visits to the Seychelles, Abyssinia and South Arabia, he has greatly advanced our knowledge of the little known and fast disappearing or changing fauna of these areas.

Dr. F. E. Simon, reader in thermodynamics in the University of Oxford ; distinguished for the development of new methods of liquefying helium and for his studies of phenomena at the lowest temperatures yet attained.

Dr. H. G. Thornton, head of the Bacteriology Department, Rothamsted Experimental Station ; distinguished for his investigations in soil bacteriology and on the relations existing between nodule-forming bacteria and their leguminous hosts.

Mr. R. A. Watson Watt, scientific adviser on telecommunications, Ministry of Aircraft Production, formerly superintendent, Radio Department, National Physical Laboratory ; distinguished for his contributions to radio engineering, particularly in relation to aerial and marine navigation.

Mr. P. Bruce White, member of the scientific staff of the National Institute for Medical Research, Hampstead ; distinguished for his fundamental studies of bacterial immunology, in particular of the antigenic constituents of members of the Salmonella group.

NEWS AND VIEWS

H. E. Armstrong Lecture

ALTHOUGH H. E. Armstrong did not take an active part in the formation of the Society of Chemical Industry, he was nevertheless one of the original members, and the Society has founded a Lecture in his memory. The task of delivering the first of what will no doubt be a series of distinguished lectures, was a difficult one, and the Society could not have selected a better man than the son of 'H. E. A.' Dr. E. F. Armstrong and his father had many interests in common; they followed the same profession, they took holidays together, and, Dr. Armstrong says, he was "closest to him over nearly sixty years", being in almost daily contact with him by letter even when separated geographically. Now Dr. Armstrong has given an intimate account of his father's life and work in the form of the first Armstrong Lecture, which was delivered on February 3. The complete Lecture has been published in *Chemistry and Industry* (Feb. 8). Some of the ground covered, particularly that relating to chemical work, was dealt with by "W. P. W." in the obituary notice which appeared in NATURE of July 24, 1937. The last part of Dr. Armstrong's lecture, however, reflected more of the personal and human aspects of the 'H. E. A.' known to the present generation of men of science, and it seemed appropriate that this portion, supplementing in some ways the obituary notice, should appear in NATURE (see p. 373), where many of Armstrong's stimulating and often provocative contributions were published.

Scientific Co-operation between Great Britain and the United States

ON March 20, the president and council of the Royal Society entertained fellows of the Society and a number of friends at a buffet luncheon at Burlington House to meet Dr. J. B. Conant, the president of Harvard University. Sir Henry Dale and Dr. Conant received the guests, who numbered more than a hundred and fifty, among whom were Sir John Anderson, Lord Hankey, the High Commissioners for Australia, Canada and South Africa, and five of Dr. Conant's colleagues in his mission, namely Dr. K. T. Bainbridge, Dr. F. L. Hovde, Dr. E. J. Poitras, Dr. Warren Weaver and Dr. Carroll L. Wilson. At the conclusion of the luncheon, in the Society's meeting room, Dr. Conant gave a brief talk. He expressed his great pleasure at meeting such a representative body of British men of science, and hoped that his visit to this country would further the co-operation between scientific workers on both sides of the Atlantic, particularly in the direction of an interchange of ideas and experiences bearing on problems arising out of the War.

Emergency Scientific Research Bureau in Eire

THE Government of Eire has set up a small advisory body, to be known as the Emergency Scientific Research Bureau, to deal primarily with the technical problems involved in the provision of substitute processes and materials during the period of the emergency. This body, which will be attached to the Department of the Taoiseach, has the following terms of reference: (1) To give technical advice to the Government on such special problems relating to industrial processes and the use of substitute materials as may be referred to them. (2) To advise the Government generally on the use of native or other materials to meet deficiencies caused by the restriction of imported raw materials and commodities. (3) To direct or conduct special researches and inquiries connected with the above.

The following have been appointed to be members of the Bureau: Prof. J. J. Dowling (chairman), professor of technical physics, University College, Dublin; Dr. J. J. Drumm; Prof. M. A. Hogan, professor of mechanical engineering, University College, Dublin; Prof. J. H. J. Poole, professor of geophysics and experimental physics, Trinity College, Dublin; Dr. T. S. Wheeler, State chemist. The secretary to the Industrial Research Council, Dr. J. J. Lennon, will act as secretary to the Bureau. The Bureau will utilize the premises of the Industrial Research Council, 45 St. Stephen's Green, Dublin.

University College, Cardiff: Air Raid Damage

UNIVERSITY College, Cardiff, has suffered to some extent in recent air raids, the most extensive damage being at the Students' Union building. The refectory of the Union, which was erected with money collected by students as a memorial to those students who lost their lives in the War of 1914–18, has been wrecked, and will probably have to be rebuilt, while the rest of the Union premises have also been badly shaken. Fortunately the new gymnasium, recently completed at a cost of £17,000, escaped almost untouched. The Cathays Park buildings of the College suffered from blast, many windows and almost all the roof lights being destroyed. The Tatem Laboratories were the most affected, and blast caused a considerable amount of damage internally to fittings and apparatus in both the Physics and the Chemistry Departments, though not enough to put these Departments out of commission for more than a few days. A fire was started in the Drapers' Library but was quickly extinguished by the fire watchers. Fire watchers at the Union luckily escaped serious injury, but one of the watchers in the College buildings has unhappily died of injuries received in the course of his duties. A young assistant on the staff of one of the visiting institutions which are at present working in University College, Cardiff, was also killed at his lodgings in the town. These casualties have caused deep regret.

Cost of Living for Working-Class Families

A FURTHER publication in the New Merseyside Series issued by the Statistics Division of the Social Science Department, University of Liverpool, deals

with the cost of living of representative working-class families (Liverpool: University Press. London: Hodder and Stoughton, Ltd. 1s.). A household consisting of father, mother and young children has been selected as representative, as well as a widow supporting two children of school age, and a husband and wife, both old-age pensioners. Essential needs are sub-divided under the usual five heads: food, clothing, rent and rates, fuel and light, sundries. In regard to food, the findings of the report of the British Medical Association Committee on Nutrition have been taken as one basis, but the specimen diets were modified to satisfy rationing regulations and to permit greater variety in diet and elasticity in cooking. The poverty standard selected is that adopted for the Merseyside Survey. The report indicates that between June 1933 and October 1940, expenditures showed increases of 57·5 per cent, 64 per cent and 76 per cent respectively for the family, widow with children, and old-age pensioners.

Comparing the estimated basic needs of these representative families, poverty standards, actual expenditure, and income from the social services, the inquiry indicates that the services concerned succeed in finding a close approximation to the cost of bare subsistence, though this is appreciably below the human needs standard. The blot on the social services is the absence of adequate provision of assistance for sick persons and their families, and the reduction in benefit when work is lost on account of illness. The report includes an analysis of actual expenditure of three typical non-earning families as well as of the average expenditure of 8,905 families, and a comparison with human needs, which suggests that the British Medical Association diets are what they were intended to be, estimates of the *minimum* expenditure on food necessary for health and working capacity. The sums spent on rent, fuel and light in the average budget are also rather higher than those allotted on the human needs standard, but the difference between the two results under the head of clothing is insignificant. The total average household expenditure revealed in the budgets collected by the Ministry of Labour is 50 per cent higher than the estimated cost of living at the human needs level.

Hindu Iconography

A VALUABLE collection of paintings and bronzes of international repute illustrating Indian art and religion has recently been added to the national collections by donation to the Department of Oriental Antiquities of the British Museum (Bloomsbury). It has been given by Mrs. E. C. Moor and was formed by her husband's grandfather, Major Edward Moor, F.R.S. (1771–1848), while gathering material for his pioneer work "The Hindu Pantheon" (1810). The collection consists of 609 objects, of which 360 are bronzes and 249 are paintings and drawings. The paintings, which with the bronzes were for the most part acquired through a pandit of Poona, to whom Moor refers and who identified the subjects, are Decani in style. Some belong to an eighteenth century Rajput school, while the most important illustrate verses by the poet Keśava Das of Bundelkund (1555–1617) and were probably executed at Jaipur in the early eighteenth century. The majority of the bronzes are of seventeenth century or eighteenth century date. The value of the collection lies in its original purpose as illustrating Hindu iconography; and as is pointed out in an account of the collection (*Brit. Mus. Quarterly*, **14**, 4; 1940), since not all of them were used in "The Hindu Pantheon" and those that were engraved for publication were "made more handsome", there is room for much fresh work on the collection. It is hoped that it will provide the nucleus of a study collection for students of Indian art and religion.

Birds of North-West England

A LIST of 270 species and five subspecies together with much original information on bird habits and movements resulting from some twenty years field-study of bird life in the area between the Ribble and the Dee and inland to Warrington were given on February 13 in a paper to the Liverpool University Biological Society by Mr. Eric Hardy, an honorary member, who reviewed the results as they had been drawn up for the Merseyside Naturalists' Association's proposed handbook on the birds of the area. Much of this work might seem idle in war-time, but the bird census and survey have disclosed items of economic importance such as the distribution and habits of useful and harmful birds on the land, which are being sent to the Royal Lancashire Agricultural Society. The increase in the distribution of wild duck, waders, gulls, crows, owls, etc., and the decrease of other birds is of more than natural history interest.

The bird census showed an average density of 6·7 birds to the acre; the house-sparrow, which forms 38 per cent of the bird population of a Liverpool suburban park, forms only 2 per cent of the population of rural Knowsley Park. Mr. Hardy pointed out that a knowledge of the economic position of bird life in an area is essential to war-time agricultural efforts in order to know what to protect and what to repress —an undertaking too often treated from a national rather than a local attitude. It has often been stated that we could not live more than nine years without birds owing to the ravages of insect pests they control; but modern field work has shown that a greater toll of insect pests like caterpillars is taken by predatory insects.

Spike Disease of Sandal

THE spike disease of sandal was first noticed forty years ago and since then numerous investigators have studied the problem. For the most recent account of the disease the reader is referred to an article by Rao Sahib S. R. Iyengar and A. L. Griffith (*Indian Forest Records*, **6**, No. 4). Work so far carried out has led to the conclusion that it is an insect-borne disease. The vector is of such a size that it can pass through a mesh of $\frac{1}{4}$ in. but is excluded by

one of $\frac{1}{10}$ in. The average period from infection to manifestation of the disease is approximately 7 months in the case of natural infection and 4½ months with artificial infection. From manifestation of the disease until death of the tree, the average period is about 15 months but varies with the girth of the tree. The transmission of the disease to healthy trees by grafting can be carried out most easily by a semi-trained staff, by leaf-grafting. Successful transmission by means of any particular insect has not so far been carried out, but suspicious spike-like symptoms have appeared in seven cases. Grafting, however, failed to transmit these same symptoms to healthy plants. While the vector is as yet unknown, the available evidence points to its being an uncommon species of insect of the order Hemiptera.

Science Masters' Association

IT is satisfactory to learn from the report of the Science Masters' Association for 1940 that the membership remains almost stationary and that the schools represented, now more than 950, show a slight increase. It is suggested that meetings of the eight branches of the Association, which were discontinued last year, should be started again in spite of difficulties, and that the Examinations' Sub-Committee might receive more criticisms from members. This work is most useful, and every effort should be made to keep it up.

Motor-Vehicle Industry in Great Britain

ACCORDING to an article in *Engineering* of January 31, new registrations of private cars in Great Britain in the first seven months of 1940 totalled only 30,200, compared with 194,500 in 1939. Since July 1940, new registrations have been taken out at the rate of only 200–300 a month. New registrations of commercial vehicles up to July were about one quarter of the corresponding figures for 1939; after July, however, there was a fall from an average of about 1,400 a month to about 300 a month as the result of the ban on sales except by special permit. Exports of private cars from the United Kingdom in 1931 numbered 17,104; in 1937 the figure was 53,655; and in 1939 it was 35,190 during January–August and only 8,040 during September–December. These figures show that the rate of export of complete cars and chassis was approximately halved as the result of the outbreak of war. A comparison of British exports and new registrations during the early months of 1940 suggests that the production of private cars was probably at the rate of 6,000 a month. This compares with about 30,000 a month during the early months of 1939 and a peak production of more than 32,000 a month in 1937. The production of private cars for the home market had thus become only a subsidiary function of the industry, the main functions of which were the provision of trucks and lorries for the Army and assistance to the aircraft industry.

On the retail side, the reduction in the sales of new vehicles has resulted in an appreciable fall in turnover of most of the firms in the industry, though this fall has probably been very much less than was anticipated at first. During the winter of 1939–40, about half a million motor-cars were laid up—approximately a quarter of the total number in use. Many of these were put back on the road in the spring. For the quarter ended June 30, 1940, receipts from motor-vehicle taxes were £850,000 higher than for the corresponding quarter of 1939. This must be considered very satisfactory, especially in view of the increased rate of tax. Motor-cycles were excluded from the ban on sales of motor-vehicles imposed in July. Up to August 1940, home sales were at the rate of about 3,000 a month, compared with rather more than 5,000 in the preceding year. A significant feature of the sales during 1940 was the high proportion of the total accounted for by motor-cycles of less than 150 c.c. capacity. These have consistently accounted for between 70 and 80 per cent of the total sales, whereas for 1939, the corresponding proportion was only about 25 per cent. It is to be hoped that the impetus given by petrol rationing to the development of the small machine in Great Britain will encourage British exporters to meet foreign competition at the end of the War.

Diesel-Engine Driven Generating Station

A NEW electric-generating station has been installed at Port Macquarie, which is a seaside town at the mouth of the Hastings River, New South Wales. The power is supplied by three Diesel engines furnished by Messrs. Blackstone and Co., Ltd., Stamford, Lincs, directly coupled to alternators having a combined output of 500 kilowatts. Two of the engines are 240 b.h.p., six-cylinder units, and the third is a 120 b.h.p. three-cylinder engine. The engines are of the latest totally enclosed design, and as the plant has to run unattended for part of the day, an alarm signal has been installed, which is claimed to give complete protection against accidents, such as an excessive rise in the lubricating oil temperature, failure of the cooling-water flow, overspeed or overloading, failure of the oil pressure or excessive temperature of the cooling water. If the alarm is not attended to within five minutes, the engine automatically stops and no damage is done. The engine room measures 70 ft. by 31 ft., and a special fuel room is provided, the fuel entering the engine room through a trench, which also accommodates the air, lubricating oil, and cooling-water pipes.

Comets

Comet Friend-Reese. Harvard Card 560 announces that Mr. Clarence L. Friend, Escondido, California, discovered a comet on January 17. It was discovered independently by Mr. E. J. Reese, Uniontown, Pennsylvania, and was described as diffuse with a nucleus, tail less than 1° in length, magnitude 10. Messrs. K. Guthe and R. M. Thomas of the Harvard Observatory have determined a position of the comet from a pre-discovery image on a Harvard plate taken with the *FA* camera (Cambridge, 1·5 in. aperture),

and from a plate taken with the *I* camera (Cambridge, 8-in. aperture). The first was on Jan. 0·9908 and the other on Jan. 29·00698, and from these and an observation on January 19 they have computed the following orbit :

T	1941 Jan. 20·633 U.T.	
ω	132° 35·9′	
Ω	329 2·9	1941·0
i	26 36·5	
q	0·94285	

Comet Encke. *Harvard Card* 561 announces that Van Biesbroeck, Yerkes Observatory, reports the discovery of this comet on Jan. 19·033. It is described as diffuse with a nucleus, the magnitude being 17. In the "Handbook of the British Astronomical Association, 1941", the late Dr. A. C. D. Crommelin gave the elements and an ephemeris, and the comet is very close to the predicted position.

Comet Paraskevopoulos (1941 *c*). This comet was discovered by Dr. John S. Paraskevopoulos, of the Boyden Station, Bloemfontein, on January 23, and also by Dr. R. Grandon and others. Its magnitude was stated to be 3·5 and its tail was 5° in length. An orbit computed by Wood and Jackson, and cabled by Dr. John Jackson, Cape of Good Hope, is given below, and also an ephemeris :

T	1941 Jan. 27·779 U.T.	
ω	268° 28′	
Ω	41 50	1941·0
i	168 08	
q	0·7894	

1941	R.A.	Dec.	ϱ	r
March 27	2h 08m	+11·3°	2·124	1·327
31	2 10	11·8		
April 4	2 11	12·3	2·323	1·435
8	2 13	12·7		
12	2 14	13·1	2·497	1·544

Comet Okabayasi – Honda (1940 *e*). This comet was discovered at Tokyo on October 4 and was described as being of magnitude 11 and possessing a nucleus. The elements of an orbit and also an ephemeris, computed by Miss E. L. Scott and Mr. H. A. Panofsky, of the University of California, are given below :

T	1940 Aug. 15·8440 U.T.	
ω	329° 50′ 16″	
Ω	127 15 15	1940·0
i	133 07 30	
q	1·06372	
e	1·00345	

1941	R.A.	Dec.	ϱ	r
March 27	1h 10·6m	48° 52′	3·903	3·314
April 4	1 17·3	49 03		
12	1 23·8	49 22	4·185	3·490
20	1 30·2	49 49		
28	1 36·0	50 22	4·410	3·663

The Night Sky in April

THE moon is full on April 11 at 21h. and new on April 26 at 13h. U.T. A naked-eye star, o Leonis (mag. 3·8) is occulted on April 7, the disappearance, as seen from Greenwich, taking place at 21h. 43·5m. at position angle 58° from the north point of the moon's image. Jupiter and its companion, Saturn, are planets of the evening sky. Both will soon be too close to the sun for observation, but they will re-emerge as morning stars towards the end of June. Mars continues as a morning star, and is 5° above the eastern horizon about 3h. 30m. U.T. in mid-April. The distant planet, Neptune, is not far from β Virginis and comes to the southern meridian shortly after 22h. U.T. in mid-April (add 1 h. to convert to Summer Time). This planet, seen as a star of magnitude 8, requires for its detection some telescopic aid and a section of a star map for guidance such as is given in the "Handbook of the British Astronomical Association, 1941", p. 9. In the same constellation is one of the best-known binary stars, γ Virginis. The components are of nearly equal magnitude (3·6 and 3·7 respectively) and their present separation is 5″; the period is about 180 years. The Lyrid meteors are most frequent about April 20, their radiant point being near 104 Herculis, that is, south-preceding the bright star, Vega.

Announcements

DR. F. C. HAPPOLD, lecturer in biochemistry in the University of Leeds, has been elected to the recently instituted readership in biochemistry.

THE Herbert Jackson Prize of the London, Midland and Scottish Railway for 1940 has been awarded to Mr. S. C. Britton, of the Metallurgical Department (Engineering Section), Derby, for his paper entitled "The Corrosion of Copper and some Copper Alloys in Atmospheres highly polluted with Coal Smoke".

THE Chemical Society will attain its centenary on March 30, and will hold the hundredth annual general meeting at Burlington House on Thursday, April 3. The business portion of the meeting will be at 12 noon when the election of Prof. J. C. Philip as president, and of those fellows nominated to fill vacancies among elected ordinary members of Council will be announced. At 2.45 Sir Robert Robinson, the retiring president, will deliver his presidential address entitled "The Mechanism of the Benzidine Rearrangement and some Related Topics". Arrangements for the celebration of the centenary of the Society have been postponed until after the War.

AT the annual general meeting of the Royal Astronomical Society held on March 14, the following officers were elected for the ensuing year : *President*, Prof. S. Chapman ; *Vice-Presidents*, Prof. David Brunt, Sir James Jeans, the Rev. T. E. R. Phillips, Prof. H. C. Plummer ; *Treasurer*, Mr. J. H. Reynolds ; *Secretaries*, Mr. D. H. Sadler, Dr. A. D. Thackeray ; *Foreign Secretary*, Sir Arthur Eddington.

THE publication "Rubber and its many Uses", by H. McKay, in "The Empire at Work" series (Oxford University Press, 1940) deals, in 76 pages, and in very simple language with the production of rubber in the plantation and the way in which it is manufactured into various articles such as sponges, tubes, tyres, tennis and golf balls, and hard rubber. The whole is well illustrated. The price is 10*d*.

LETTERS TO THE EDITORS

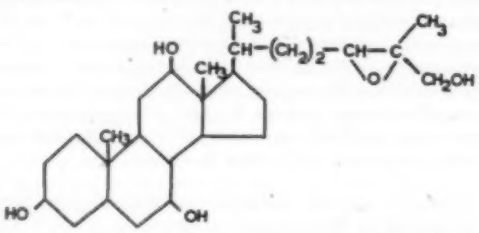
The Editors do not hold themselves responsible for opinions expressed by their correspondents. They cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

IN THE PRESENT CIRCUMSTANCES, PROOFS OF "LETTERS" WILL NOT BE SUBMITTED TO CORRESPONDENTS OUTSIDE GREAT BRITAIN.

Bile Acids of Elasmobranch Fish

THE bile of bony fishes, like that of birds and mammals, contains acids in which glycine or taurine is conjugated with mono-, di-, and tri-hydroxy derivatives of cholanic acid. On the other hand, Hammarsten[1] isolated from the bile of the shark, *Scymnus borealis*, acids which he showed to be sulphuric esters of neutral compounds, chiefly α-scymnol. The constitution of scymnol has been largely elucidated by the investigations of Windaus, Bergmann and König[2], and of Tschesche[3], who have shown that the compound is related to the commoner bile acids, but contains eight carbon atoms in the side chain like cholesterol, whereas the usual bile acids contain only five. This has considerable bearing on the view that the bile acids arise from the degradation of cholesterol, and it has been suggested[2] that the shark, which belongs to a primitive order of fish, lacks the ability to effect more extensive oxidation of cholesterol to the bile acids. This is evidently not entirely true, for Ota[4] has recently isolated cholic acid as well as scymnol from the bile of a species of shark found in Japanese waters.

The correspondence in positions and configurations of the nuclear hydroxyl groups of scymnol and cholic acid has been established by Ashikari[5] who degraded scymnol to cholic acid. The following is accordingly the structure of scymnol, the evidence for the ethylene oxide ring being somewhat inconclusive.



The scymnol used by Ashikari was isolated from the bile of *Dasyatis akajei*, a species of sting ray found in Japanese waters. An examination has now been made of the bile of the blue skate, *Raia batis*, and the grey dogfish, *Squalus acanthias*, caught off the Faroes during the summer and autumn. Immediately after the fish were killed the gall bladders were squeezed into a large excess of absolute alcohol, and the alcoholic bile was afterwards worked up as described by Windaus *et al.*[2] Pure scymnol, m.p. 192–193° (corr.) was readily isolated in considerable quantity, from the bile of both of these cartilaginous fish. It had $[\alpha]_D^{20} = +39{\cdot}4°$ ($c = 2{\cdot}614$ in alcohol, (found: C, 72·1; H, 10·1. calc. for $C_{27}H_{44}O_5$, C, 71·9; H, 10·3 per cent.). There were minor amounts of resinous bile acids from which a pure component has not yet been isolated. Alkaline hydrolysis of the bile from the teleostean angler fish (*Lophius piscatorius*) gave no water-insoluble product so that scymnol-sulphuric acid was not present. Scymnol, esterified with sulphuric acid, thus appears to be a characteristic major component of the bile of elasmobranch fish.

The scymnol obtained from the skate bile was further characterized by conversion into the dihydrate[4], the hydrochloride[5], and the tetra-acetyl derivative[3] (this was prepared by Dr. J. D. Loudon). In preliminary experiments on the isolation from both skate bile and dogfish bile complications arose from the fact that purification of the crude dihydrate by crystallization from ethyl acetate gave a product which formed colourless slender needles, m.p. 138–140°. This evidently still contained water of crystallization. (Found: C, 70·7; H, 10·4. $C_{27}H_{44}O_5.\frac{1}{2}H_2O$ requires C, 70·5; 10·3 per cent.) Its formation was apparently associated with the quality of the ethyl acetate, for it was rapidly and completely transformed into anhydrous scymnol when warmed with pure ethyl acetate obtained from another source.

This investigation, which is being continued, was made possible by the co-operation of Dr. J. A. Lovern, of the Torry Research Station, Aberdeen (Department of Scientific and Industrial Research) who kindly arranged for the collection of the bile.

J. W. COOK.

Chemistry Department,
University of Glasgow.
Feb. 22.

[1] Hammarsten, O., *Z. physiol. Chem.*, **24**, 322 (1898).
[2] Windaus, A., Bergmann, W., and König, G., *Z. physiol. Chem.*, **189**, 148 (1930).
[3] Tschesche, R., *Z. physiol. Chem.*, **203**, 263 (1931).
[4] Ota, K., *J. Biochem.* (Japan), **29**, 241 (1939).
[5] Ashikari, H., *J. Biochem.* (Japan), p. 319.
[6] Compare Oikawa, S., *J. Biochem.* (Japan), **5**, 63 (1925).

Insect Cuticle as an Asymmetrical Membrane

IN a recent communication[1], I provided evidence to show that the permeability of the outer 'lipoid layer' of insect cuticle to feebly dissociating substances of high dielectric constant may be greatly increased by relatively apolar substances of low dielectric constant. Since then I have obtained similar results for the outer cutinized layers of a number of plant epidermal membranes. The physical and chemical properties of plant 'cutin' are said to resemble those of the insect 'epicuticle' or 'lipoid layer'[2], and this suggested that induced penetration of polar substances was not a fundamental characteristic of insect cuticle, but might take place with relatively simpler artificial membranes.

The permeability of thin rubber membranes was found to be similar to that of insect 'epicuticle' or plant 'cutin'. Rubber swells readily in oils of low dielectric constant such as kerosene, but imbibes relatively small proportions of oils of higher dielectric constant such as oleic acid or castor oil. Rubber membranes are only slightly permeable to ethyl alcohol, but the presence of kerosene in the disperse phase of the membrane framework increases the permeability of the membrane to ethyl alcohol, which is miscible with kerosene. This effect is negligible with oleic acid or castor oil.

Similar considerations apply to other membrane systems. Collodion imbibes 'gelifying liquids' such as ethyl or propyl alcohols, whereas kerosene is less readily imbibed and will precipitate collodion from solution in a mixture of ethyl alcohol and ether. 'Cellophane' and parchment membranes imbibe water more readily than ethyl alcohol or kerosene. As with collodion, the permeability of such membranes to ethyl alcohol is not increased by oils of the kerosene type. These observations stress the importance of the physico-chemical relation between a membrane and permeating substance in determining whether the permeability of the membrane to this particular substance might be modified by the introduction of other components into the system. Generally, it would appear that the permeability of apolar hydrofuge membranes to relatively polar substances is increased by substances of intermediate polarity which are more readily imbibed by the membranes. The degrees of induced penetration will depend partly on the mutual solubilities of the mixture of permeating substances, and partly on the rates at which the polar substances diffuse from the membranes. This generalization also applies to the induced penetration of apolar substances through relatively polar hydrophil membrane systems. The application of some of these results to insecticidal work may be shown by the fact that a mixture of ethyl alcohol and kerosene is very toxic to larvæ of the blowfly Calliphora (*vide* Hurst[1]), but mixtures of ethyl alcohol with oleic acid or castor oil are only slightly toxic.

Insect cuticle possesses a high degree of asymmetry depending on the association between the external hydrofuge 'lipoid layer' and the internal hydrophil protein-chitin complex. This asymmetry has an important effect on the permeability of the whole cuticle, and is modified in different insects by the relative distribution and physical properties of the soluble and insoluble components of the cuticle framework. The effects of such asymmetry on permeability may be demonstrated with artificial membranes prepared by impregnating one surface of parchment with collodion or rubber. The simplest approach is to consider the behaviour of the permeating substance within the membrane framework. Each substance diffuses most readily towards that region of the membrane which offers least resistance to its penetration, so that under standard conditions the whole membrane is more permeable in this direction. Experiments have shown that the rate of evaporation of solvents through asymmetrical membranes is greater in the direction of more rapid diffusion.

The differences in permeability in opposite directions through a membrane have long been known to workers with animal membranes[2]. Similar results have been obtained for artificial membranes[4] and plant membranes[5], and it was supposed that this behaviour was due to the 'double' nature of the membranes. The present results throw some light on the underlying mechanism of this behaviour. The importance of asymmetry in membrane permeability is shown by the fact that combinations of asymmetrical membranes may be more permeable to a particular substance than the *single* components of the membrane systems. Water evaporates through the cuticle of Calliphora larvæ more than one hundred times as rapidly in the direction lipoid layer → chitin layer than in the opposite direction, while there is an intermediate rate of evaporation through two such cuticles in which the lipoid layers are in contact. Using various solvents, similar results have been obtained with a number of insect cuticles, plant membranes and artificial asymmetrical systems.

Membrane system		Permeating solvent	Direction of more rapid diffusion	Direction of max. rate of evaporation
A	*B*			
Rubber	Parchment	Water	$A \rightarrow B$	$A \rightarrow B$
,,	,,	Ethyl alcohol	$B \rightarrow A$	$B \rightarrow A$
,,	,,	Kerosene	$B \rightarrow A$	$B \rightarrow A$
Collodion	Parchment	Water	$A \rightarrow B$	$A \rightarrow B$
,,	,,	Ethyl alcohol	$B \rightarrow A$	$B \rightarrow A$
,,	,,	Kerosene	$A \rightarrow B$	$A \rightarrow B$

In the living insect, the cuticle asymmetry is partly regulated by the free lipoid in the outer 'lipoid layer', which is specially adapted to maintain a physiological balance in each particular cuticle. This balance may be upset when the free lipoid from one insect cuticle comes in contact with the cuticle of another. When Cálliphora larvæ are allowed to remain in contact with the relatively hard-bodied Tenebrio larvæ, the latter gradually lose water by excessive evaporation and die from desiccation, while there is no increase in the rate of water loss from the soft-bodied insects. This has been correlated with the fact that the free lipoid in the cuticle of Calliphora is distinctly more hydrophilic than that in the cuticle of Tenebrio; a similar desiccation takes place when hard-bodied insects are smeared with lecithin. This does not occur, however, with hard chitinous structures, such as blowfly puparia, where the high degree of impermeability is largely dependent on the insolubility and rigidity of the condensed chitin-protein complex.[6]

In biological systems, asymmetrical colloidal associations occur at various protoplasmic interfaces. The present work indicates that the permeability of such complex associations is not necessarily deducible from summation of the permeabilities of the component phases and suggests a need for reconsideration of certain fundamental assumptions concerning the permeability of membranes.

This work was made possible by means of a grant made to the Imperial College by the Department of Scientific and Industrial Research, and a full account will be given elsewhere.

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March 3.

[1] Hurst, H., NATURE, **145**, 462 (1940).
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Isolation of Rhamnose Derivatives from *Ulva lactuca*

WORKING on algæ other than the Chlorophyceæ, various investigators have established the existence of algal polysaccharides containing mannuronic, galactose or fucose residues, the two latter being in the form of sulphuric acid esters. An investigation of *Ulva lactuca*, a member of the Chlorophyceæ, undertaken with the hope of ultimate correlation with pigmentation, has unexpectedly revealed the presence of a rhamnose polysaccharide, hitherto unknown among algal products.

Without a complete purification of the weakly acidic, non-reducing Ulva carbohydrate, evidence was obtained for an acid sulphuric ester structure and the absence of uronic acid residues. By furfural estimation a methyl pentose content of approximately 25 per cent was established, and on hydrolysis by dilute acids, preferential fissure of the methyl pentose residues occurred to some extent.

Rhamnose was identified as a constituent of the hydrolysate, by a fractional distillation after methylation of the syrupy sugar mixture, and the subsequent isolation of crystalline 2 : 3 : 4-tri-methyl rhamnose anilide and 2 : 3 : 4-tri-methyl rhamnose phenyl hydrazone.

Interruption of this work has prevented the complete identification of a very labile constituent of the hydrolysate. Investigation of the other hydrolysis products, together with an investigation of the methylated polysaccharide, will be undertaken as soon as the work can be resumed.

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E. D. JOHNSON.

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Surrey.
March 3.

Tadpoles out of Season

BY pituitary treatment of an appropriate species of Rana at the appropriate time of year it has been shown by Rugh[1] in the United States that fertilized eggs and developing tadpoles can be obtained the whole year round. I have found that during the winter months (November–February) fertilized eggs and tadpoles of *Rana temporaria* can be readily obtained by the same methods, although the reaction of this species to pituitary treatment is somewhat different.

Briefly, Rugh's techniqueis to inject in saline the whole *partes anteriores* of pituitaries freshly excised from frogs of the same species, into the cœlomic cavity of the adult frog by means of a large hypodermic needle. By controlling the dose and time of injection, amplexus in the male can be made to synchronize with ovulation in the female. In the frogs used by Rugh (*Rana pipiens, R. clamitans, R. catesbeiana, R. sphenocephala, Acris gryllus*) egg-laying follows treatment within twenty-four hours at room temperature, although it may be delayed up to five days by smaller doses. In *R. temporaria*, however, a period of about twenty-one days elapses between injection and egg-laying in the female and about eighteen days between injection and amplexus in the male, so that fertilized eggs may be expected about the twenty-first day. Moreover, these times appear to be little affected by variations in dosage, so that control is simple. A single peritoneal injection of 0·25 c.c. of saline containing anything from three to six glands excised from adult females will produce ovulation or amplexus. Six glands excised from adult males will suffice instead. When the frogs begin to copulate each pair should be placed in a separate vessel containing fresh pond water. After the spawn is shed and fertilized some three days later, the frogs should be removed. The tadpoles produced in this way appear to be in every respect normal.

H. METTEN.

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St. Bartholomew's Medical College,
at
The Zoology Laboratory,
Cambridge.
Feb. 28.

[1] Rugh, R., *Science*, **85**, 588–589 (1937).

Soil Protozoa in some Chinese Soils

FORTY soil samples collected around Kiating and its vicinity, Szechuen, have been studied. Fifty-seven species of Protozoa were recorded: 24 species flagellates, 10 species Sarcodina and 23 species ciliates. Among them, several species were found for the first time in soil. They are, among the flagellates, *Cryptochrysis commutata*, *Peridinium* sp.; among the Sarcodina, *Amœba guttula*, *Amœba striata*; and among the ciliates, *Frontonia* sp., *Chilodon capucinus*, *Chilodon fluviatilis*, *Vorticella chlorostigma*, *Vorticella nutans*. The most common species found are *Oikomonas termo*, *Monas vulgaris*, *Amœba limax*, *Hartmanella hyalina*, *Cercomonas longicauda*, *Naegleria gruberi* and *Colpoda cucullus*. They are present in 70–100 per cent of the samples examined. Casual observations indicate that the greatest number of species found in one single sample is around seventeen, and the least one or two.

The numbers of Protozoa per gram of soil were determined by the dilution method for twenty soil samples. The highest number found was 112,500 (rice field, clay) and the smallest number 65 (barren sand, loamy sand). Flagellates are present in far greater numbers than the Sarcodina and ciliates.

H. ZANYIN GAW.

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Oct. 1.

Discreteness of Sensations

IN 1938 I observed the fluctuation of the threshold of hearing[1]. As proved by recent experiments, this phenomenon is also applicable in the field of vision and touch, and is characterized by the discreteness of sensations.

The phenomenon has been investigated in the following way. The observer receives auditory, visual or tactual impulses of equal duration (0·3 sec.) at equal intervals (0·45 sec.). As the force of the impulse decreases, the impulses become less clear or loud, and they seem to be of lesser duration, according to the integral law of apparent duration[2], but all

remain exactly alike as compared with one another. With a further decrease in the force of the impulse, there comes a moment when one or another impulse ceases to resemble the others and appears shorter. This moment is defined as the 'beginning of fluctuation'. When the force of the stimulus is still further decreased, there is a new moment when one or the other impulses vanishes completely—'middle of fluctuation'. The next moment, when all of the impulses vanish, is considered the individual threshold of sensitivity of the given observer, i.

Numerous measurements have shown that the beginning of fluctuation comes when the intensity of the stimulus is four times the individual threshold (6 db.), and the middle of fluctuation comes when the intensity is 1·6 times the threshold (2 db.). The intensity of 0·6 of the threshold (0·6 i) represents the amplitude of fluctuation, and one and the same values were obtained for hearing, vision and touch. The same value of 0·6 of the threshold was obtained for hearing within the limits of 200–3,000 Herz, although the sensitivity of the ear changes 1,000 times within this range.

The phenomenon of fluctuation of the threshold of sensitivity can be explained if we realize that our sensations increase in jumps, or steps, and, furthermore, that the size of each such step is equivalent to the amplitude of fluctuation, that is, to 0·6 i (where i is the threshold of sensitivity). I find five such steps, after which they become unobservable as compared to the increased loudness. (Fig. 1).

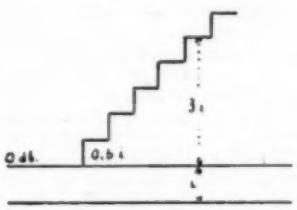

Fig. 1.

Another series of experiments which confirms these results consisted of the following:

A number of impulses having a duration of 0·75 sec. were given, one after the other, at intervals of 0·75 sec. Further, two impulses were given simultaneously, one for vision (a neon lamp connected to a case having an opening of 0·5 cm.), and the other for hearing (a telephone). Thus both impulses are received at the same time. The visual impulse serves as an indicator and its brightness remains constant throughout the duration of the experiments; the loudness of the sound impulse changes. At the beginning, both impulses are of the same duration—both begin and end simultaneously (Fig. 2*a*). As the loudness is decreased, the sound impulse begins to lag, at first scarcely noticeably (Fig. 2*b*); later it lags by half the visual impulse (Fig. 2*c*), and at the end there remains but one element of sensation, one sound dot at the end of the visual impulse (Fig. 2*d*). This takes place when the intensity of sound is equal to 1·6 i (when the loudness is 2 db.), that is, exactly at an intensity which corresponds to the middle of fluctuation.

The time by which the sound impulse lags corresponds exactly to the time necessary for the accumulation of the elementary work of sound (1·6 it), which is necessary for one element of sensation.

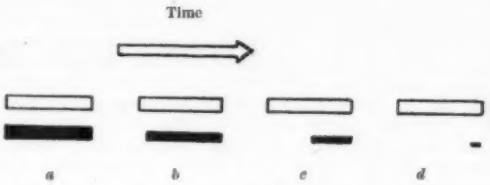

Fig. 2.

The experiments confirmed very well the equation connecting the intensity of sound, I, the individual threshold of the observer, i, the duration of the impulse, t, and the extent of the lag $\triangle t$:

$$10 \lg \frac{I}{i} = 2 + 10 \lg \frac{t}{\triangle t}, \qquad (1)$$

The visual and sound impulses can be interchanged: the sound will then serve as an indicator and the visual impulse will vary in brightness. The visual impulse will then lag and will be shortened, as shown in Fig. 2. The element of visual sensation will be obtained when the intensity of light is equal to 1·6 i, and the time of the lag can be determined from equation (1). Experiment has shown that the same thing occurs with the tactual impulse. In this case, the indicator may be either the visual or the sound impulse.

Other experiments with impulses of greater duration have shown that the time for the accumulation of the elementary work of the impulse may reach many seconds.

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[1] Lifshitz, S., *J. Acous. Soc. Amer.*, **11** (1938).
[2] Lifshitz, S., *J. Acous. Soc. Amer.*, **5**, 31 (1933); **7**, 213 (1936).

Catalysis by Activated Copper Sulphide

60 gm. carefully purified acetaldehyde and 30 gm. copper sulphide, activated by oxidizing a part of its surface into cupric sulphate, were sealed in a tube of Pyrex glass and kept at 15–20° for 24 days. At the end of this time, 60 per cent of the reactant was converted into paraldehyde, which was identified by determining the boiling point, the melting point and the mixed melting point with an authentic sample. In a control experiment without catalyst, 98 per cent of the acetaldehyde could be recovered.

It follows that the activated copper sulphide is a catalyst not only for the conversion of certain petroleum hydrocarbons[1] but also for a low molecular polymerization involving the opening of a carbonyl bond.

ALBERT WASSERMANN.

[1] Wassermann, *Brit. Pat.*, 499958, French Pat., 838379, U.S.A. Pat., filed May 1938, Application No. 208695. Ingold and Wassermann, *Trans. Farad. Soc.*, **35**, 1022 (1939).

STONE AGE MAN IN CEYLON

P. E. P. DERANIYAGALA has written an important paper entitled "The Stone Age and Cave Men of Ceylon (*J. Roy. Asiatic Soc.*, Ceylon Branch, **34**, 92; September 1940). Before 1936, the conclusions at which specialists had arrived relating to the prehistoric stone artefacts of Ceylon were extremely divergent owing to the absence of glacial deposits and of vertebrate fossils upon which these conclusions might be based. The second impediment no longer exists. Recent discoveries of an extinct hippopotamus, rhinoceros and race of elephant associated with stone artefacts may, it is argued, be assigned to the Upper Pleistocene, being younger than the Narbudda deposits of the Middle Pleistocene in which the hippopotamus occurs with three extinct proboscidian genera. The presence of the lion fossil and the absence of tiger and king cobra in Ceylon suggest that the island's extinct fauna entered before the last two descended far into peninsular India, while the absence of the horse indicates that the large extinct mammals entered Ceylon after the extinction, temporary or final, of this ungulate in India. If this be correct, these fossils of Ceylon must be regarded as comparatively recent; nor can the primitive stone artefacts be held to be the earliest handiwork of man, while the hitherto unexplored river terraces may reveal an earlier phase when stone cultures began in the island.

Man possibly entered Ceylon before developing the technique of making implements of stone, and acquired this art independently after the isolation of the island. Lacking the incentive of northern invasian which affected his continental relatives, he failed to advance beyond a phase akin to the Abbevellian, in which indeed he remained almost to the end of the early stone age culture of Ceylon in Pleistocene times or later. The poorly developed second phase of early stone age culture was replaced by the neolithic by a transition sufficiently abrupt to suggest that Ceylon's palæolithic man accompanied the hippopotamus and other large mammals into extinction, possibly as a result of an arid spell. The further possibility exists that when India and Ceylon were reconnected, the stone age races of India overran the island, and palæolithic man, if not already extinct, was unable to withstand their superior numbers and more efficient weapons.

The tendency of the Veddas to throw back to two physical types differing from other races in Ceylon, suggests that more than one neolithic race entered the island, a view supported by the occurrence in India of certain ancient pre-Dravidian races—Irula, Panyan, Kurumba, etc.

During Pleistocene times and later, Ceylon seems to have been united with India during both warm and cold spells. The final separation was still incomplete even so late as early historic times, as appears in the Ramayana. In addition, the topography of Ceylon fluctuated considerably, earth movements apparently bringing about a swift river phase, which was replaced by a phase of slow rivers and lakes, followed by further movement in which the lakes and many rivers disappeared, leaving only small streams or a series of swamps. The broad valley between the central mountain mass of Sri Padhé, or Adam's Peak, and the outlying range to its south-west is a source of fossils and artefacts, which also occur in the adjoining strike valleys. These comprise the Ratnapura series, which display much superficial laterization, possibly as a result of the south-west monsoon.

As the best evidence, both palæontological and archæological, is derived from the deposits of the strike valleys of this area, it is proposed to give to this stone age culture the name *Ratnapura*. It comprises two phases, of which the lower and earlier is extremely crude without any well-defined general shapes, has a crude flaking technique with scarcely any retouching, and contains a considerable proportion of pebble artefacts. The implements are about half the size of the quartzite palæoliths of Madras and show more affinity to the early Soan of Northern India. The materials employed are chert, quartz, corundum and jasper. The upper Ratnapura implements are smaller than those of the lower culture, and show some attempt at retouching, scraper-like forms and the commencement of a crude hand-axe; and also entire crystals of quartz or corundum, sometimes flaked to a sharp edge at the apex and roughly chipped, were employed. The upper phase did not develop far before it became extinct.

The relative scarcity or absence of palæoliths from the highest of the peneplanes of Ceylon suggests that during palæolithic times this region was too cold for autochthonous tropical races, as it is partially to-day. Since neolithic implements abound here, it is possible that either one neolithic race was driven into the cold area by another, or that all the neolithic races were forced into it by the advent of metal-using man. Being thus thrown together, they interbred and degenerated into the so-called Veddas, who never manufactured metal implements and use shells for this purpose down to the present day. Neolithic man inhabited caves, and his implements appear to be mainly composite, that is, set in a wooden handle, as the stone artefacts are too small for use as single weapons. These stone artefacts usually occur at two levels, those of the lower being twice as large as those from the upper, which also possesses a greater number of types. The culture failed to develop so far as that of India, and the art of grinding and polishing was almost unknown. Generally, the implements are little worked if made of quartz; but occasional pigmy implements are as delicately finished as Solutrean. The name Balangoda is proposed for this culture, after the cave from which the implements are best known. The common type of pottery found in the deposits has a wicker or mat-basket design, but another form, probably prehistoric, has a wicker-loop design on the inner surface. Certain types of potsherd found in both neolithic and protohistoric appear to have survived with little variation down to modern times. Pieces of hæmatite show flat surfaces where they have been ground for pigment. Bone splinters ground to a point at one or both ends were possibly used as borers, needles, or for fishing.

The best prehistoric deposits occurred in caves notably difficult of access, but close to a stream which flowed down the rock near the entrance. Each cave possessed a sandy outer platform with a look-out rock, and lay under the shelter of a large over-

hanging shelf of rock. Neolithic man generally piled his refuse not at the cave mouth but on one side of the platform.

A number of the caves have been investigated, and from the evidence of the deposits of which details are given, it is apparent that the neolithic colony inhabiting a rock shelter comprised several families, of which the men were hunters, trappers and fishers, while the women collected fruit, nuts and shell-fish. Some degree of agriculture may have been practised. Calcined bones furnish evidence of the use of fire and the practice of roasting game.

PRODUCTION OF DRUGS WITHIN THE BRITISH EMPIRE

THE Appendix to the recently published War Memorandum by the Medical Research Council on "Economy in the Use of Drugs in War-Time" (H.M. Stationery Office. 3*d*. net) is of more durable interest than the body of the Memorandum, since it proposes a long-term plan for the cultivation of medicinal plants, whereas the special need for economy in the prescription of scarce drugs will pass with the emergency. The Appendix consists of two lists of drugs the cultivation of which in the British Empire should be encouraged. The first list relates to domestic production and the second to production in the Colonial Empire. It is not proposed to comment, in this note, on all the items named in the Appendix, but to make a few observations based upon the results of experimental work designed to ascertain whether it is feasible to cultivate economically and on a commercial scale, either at home or in some Empire country overseas, certain medicinal plants for the supply of which Great Britain has paid tribute in the past to foreign nations.

Taking first the list of drugs which the Memorandum recommends for production in the United Kingdom, it is proposed to refer to cascara sagrada, ergot, dill, gentian and lobelia. In the past the bulk of Great Britain's large imports of cascara sagrada has been supplied from forests on the American side of the north-west Pacific coast; contributions from the Canadian side have been comparatively small. Experiments have proved that the shrub from which the bark is peeled can be grown in certain soils in Great Britain as a coppice crop on a five-year rotation. An additional advantage of home cultivation is that the wood remaining after the bark has been peeled from it could be converted into charcoal equal in quality to that obtained from alder buckthorn for the manufacture of explosives.

Ergot, of which large quantities are consumed by the British drug manufacturing industry, is supplied mainly by Portugal and Spain. It could be produced in Great Britain, the most favourable places for this purpose being in the west of England and in Wales. Already plans have been laid for experiments, and research workers are devoting attention to the selection of the species and strain of the fungus. It is satisfactory to know that the danger of a serious infection of cereals other than rye is slight. The aim is to select strains of high alkaloidal content, and it may be observed that much of the information concerning the alkaloidal content dates back to the time before the discovery of the alkaloid ergometrine. Chemical methods of analysis for differentiating water-soluble alkaloid (ergometrine group) from water-insoluble alkaloid (ergotoxine group) have been devised, and it seems desirable that cultivation experiments should be controlled on this basis. Incidentally, publications from the Pharmacopœia laboratory have indicated the possibility that the official standards of the British Pharmacopœia will be eventually on this basis.

Dill, which was formerly supplied largely from Germany, can be grown as a cover crop with caraway, the dill being harvested in the first year and the caraway in the second; similarly, coriander, which is already cultivated in England, may be used as a cover crop for caraway. With regard to gentian, which in normal times was imported from Italy, Spain and France, there are definite grounds for stating that it could be grown in Great Britain, but several years are needed to develop the large roots which are preferred in the London drug market. Lobelia, the present source of supply of which is the United States, can be grown on moderate to light soils in the southern half of England.

Coming now to the list of some forty vegetable drugs and essential oil-yielding plants which the Memorandum recommends for cultivation in some parts of the British Empire overseas, it is satisfactory to know that the following are already in production in India: nux vomica, podophyllum resin, rhubarb, belladonna, digitalis, henbane, jalap, lobelia, opium, squill, senna, santonin, karaya gum, and the following oils: arachis, eucalyptus, hydnocarpus and castor. The cultivation in India of psyllium and agar could also be developed, and there seems but little reason to doubt that some of the soils and climates of India are suitable for the cultivation of some of the other substances in the list set out by the Medical Research Council.

Australia, too, and New Zealand are countries which can supply some of Britain's needs for drugs. Such substances as digitalis, ephedra, ergot, liquorice, peppermint and pyrethrum, should repay investigation by cultivation in suitable places in Australia. The leaves of a tree indigenous to Australia contain hyoscyamine and hyoscine, and should prove a valuable source of these alkaloids. New Zealand is already a potential source of digitalis; it is produced there in commercial quantities. The species of fungus which grows on Festuca ergot in New Zealand is esteemed as a source of ergotamine. Many other drugs in the list could be grown economically in that Dominion. Canada has not been a fruitful source of vegetable materia medica, but there is little doubt that some of the drugs which are supplied by the United States could be cultivated successfully in Canada. Another British country which has given good promise as a source of vegetable drugs is Kenya, and it is understood that official encouragement will continue to be given to experimental stations in this colony.

FORTHCOMING EVENTS

Monday, March 31

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, London, S.W.7), at 5 p.m.—Mr. S. H. Beaver: "Railways of the Balkan Peninsula".

Wednesday, April 2

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 2.30 p.m.—Rt. Hon. Lord Horder: "The Modern Troglodyte".

INSTITUTION OF NAVAL ARCHITECTS (at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2). Eighty-second Annual Meeting.

Thursday, April 3

CHEMICAL SOCIETY (at Burlington House, Piccadilly, London, W.1), at 12 noon—Hundredth Annual General Meeting. 2.45 p.m.—Sir Robert Robinson, F.R.S.: "The Mechanism of the Benzidine Rearrangement and some Related Topics".

LINNEAN SOCIETY OF LONDON (at Burlington House, Piccadilly, London, W.1), at 3 p.m.—Sir Arthur Hill, F.R.S.: "The Centenary of the Royal Botanic Gardens, Kew".

Friday, April 4

INSTITUTION OF CHEMICAL ENGINEERS (at the Connaught Rooms, Great Queen Street, London, W.C.2), at 11 a.m.—Nineteenth Annual Corporate Meeting. 11.45 a.m.—Presidential Address: "Some Post-War Problems".

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

CHEMIST AT THORPE POWER STATION—The City Electrical Engineer, 4 Duke Street, Norwich (April 2).

TEACHER IN THE MECHANICAL ENGINEERING DEPARTMENT—The Principal, Technical College, Wolverton, Bucks. (April 4).

ASSISTANT INSPECTOR (MALE) OF SCHOOLS—The Director of Education, Education Office, Chapel Street, Salford 3 (April 5).

PRINCIPAL OF THE CARDIFF TECHNICAL COLLEGE—The Director of Education, City Hall, Cardiff (April 7).

HEADMASTER for St. John's School, Concepcion, Chile—The British Council, 3 Hanover Street, London, W.1 (quoting 'Concepcion') (April 9).

MASTER for St. Julian's School, Carcavelos, Portugal, TO TEACH MATHEMATICS AND ELEMENTARY SCIENCE—The British Council, 3 Hanover Street, London, W.1 (quoting 'Portugal') (April 9).

ASSISTANT LECTURER IN THE DEPARTMENT OF PHYSIOLOGY—The Secretary, The University, Edmund Street, Birmingham 3 (April 25).

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Freshwater Biological Association of the British Empire. Scientific Publication No. 4: A Key to the British Water Bugs (Hemiptera-Heteroptera, excluding Corixidae), with Notes on their Ecology. By Dr. T. T. Macan. Pp. 36. (Ambleside: Freshwater Biological Association of the British Empire.) 1*s.* 6*d.* [192

India at War: a Record and a Review, 1939–1940. By Sir George Dunbar. Pp. 32. (London: H.M. Stationery Office.) 2*s.* 6*d.* net. [192

Transactions of the Royal Society of Edinburgh. Vol. 60, Part 2, No. 10: The Arborescent *Senecios* of Kilimanjaro, a Study in Ecological Anatomy. By C. Leighton Hare. Pp. 355–371+2 plates. (Edinburgh and London: Oliver and Boyd.) 3*s.* [192

The Lily Year-Book, 1940. (No. 9.) Pp. iv+96+27 plates. (London: Royal Horticultural Society.) 5*s.* [272

University of Liverpool: Social Science Department, Statistics Division. Cost of Living of Representative Working Class Families. Pp. 28. (Liverpool: University Press of Liverpool; London: Hodder and Stoughton, Ltd.) 1*s.* [282

Sheffield City Libraries. Research Bulletin No. 5: A Select Bibliography on the Production of Steel Sheets and Strip, Part 3: Sheet and Strip Testing and Inspection. Pp. 24. (Sheffield: Central Library.) 3*d.* [63

Other Countries

City of Durban: Durban Museum and Art Gallery. Annual Report for Municipal Year 1939–1940. Pp. 12+4 plates. (Durban: Durban Museum and Art Gallery.) [122

Smithsonian Miscellaneous Collections. Vol. 99, No. 18: Two New Races of Passerine Birds from Thailand. By H. G. Deignan. (Publication 3605.) Pp. ii+4. (Washington, D.C.: Smithsonian Institution.) [122

Colony of Mauritius: Department of Agriculture. Sugarcane Research Station Bulletin No. 17: An Investigation into the Origin of the Sugarcane Variety Uba Marot, by G. C. Stevenson; The Spread of New Varieties of Sugarcane in Mauritius, by N. Craig. Pp. 18. (Port Louis: Government Printer.) 25 cents. [122

Pocket Natural History No. 8 (Zoological Series No. 3): A Field Key to our Common Birds. By Irene T. Rorimer. Pp. 160 (18 plates). 1.50 dollars. Pocket Natural History No. 9 (Geological Series No. 1): The Geology of the Cleveland Region. By Dr. Arthur B. Williams. Pp. ii+62. 50 cents. (Cleveland, Ohio: Cleveland Museum of Natural History.) [122

United States Department of Agriculture. Technical Bulletin No. 706: Wild Animal Damage to Seed and Seedlings on Cut-over Douglas Fir Lands of Oregon and Washington. By A. W. Moore. Pp. 28. 5 cents. Technical Bulletin No. 741: Three Species of the Genus *Lygus* and their relation to Alfalfa Seed Production in Southern Arizona and California. By Loyd L. Stitt. Pp. 20. 5 cents. (Washington, D.C.: Government Printing Office.) [122

Proceedings of the American Academy of Arts and Sciences. Vol. 74, No. 7: A Revision of the Nearctic Hemerobiidae, Berothidae, Sisyridae, Polystoechotidae and Dilaridae (Neuroptera). By F. M. Carpenter. Pp. 193–280+3 plates. (Boston, Mass.: American Academy of Arts and Sciences.) 2.25 dollars. [192

Proceedings of the California Academy of Sciences, Fourth Series, Vol. 20, Nos. 12, 13, 14: Report of the President of the Academy for the Year 1931, by C. E. Grunsky; Report of the Director of the Museum and of the Aquarium for the Year 1931, by Barton Warren Evermann; Report of the President of the Academy and Acting Director of the Museum and the Aquarium for the Year 1932, with Departmental Reports for the Two Years 1931 and 1932, by C. E. Grunsky. Pp. 473–522. Vol. 23, No. 29: The Neotropical Anchovies of the Genus *Amplova*. By George Sprague Myers. Pp. 437–442. (San Francisco: California Academy of Sciences.) [192

Department of Agriculture: Trinidad and Tobago. Vol. 1, Part 7: Flora of Trinidad and Tobago—Myrtales (concl.), Passiflorales, Plocadales, Umbellales. By E. E. Cheesman. Pp. 411–464. 54 cents. Vol. 2, Part 2: Flora of Trinidad and Tobago—Asterales, by E. E. Cheesman; Campanales, by E. E. Cheesman; Ericales, by A. W. Hill and B. L. Burtt; Primulales, by E. E. Cheesman. Pp. 49–122. 84 cents. (Port of Spain: Government Printing Office.) [192

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 134: Studies on Bovine Mastitis, 1: Study of an Experimental Herd. From the Division of Animal Health and Nutrition. Pp. 10+74 plates. (Melbourne: Government Printer.) [192

Smithsonian Miscellaneous Collections. Vol. 99, No. 14: The Male Genitalia of Hymenoptera. By R. E. Snodgrass. (Publication 3590.) Pp. ii+86+33 plates. Vol. 99, No. 17: Increased Stimulation of the Alga *Stichococcus bacillaris* by Successive Exposures to Short Wave Lengths of the Ultraviolet. By Florence Meier Chase. (Publication 3603.) Pp. ii+16+2 plates. (Washington, D.C.: Smithsonian Institution.) [192

United States Department of Agriculture. Circular No. 572: Life History and Control of the Imported Willow Leaf Beetle. By Clifford E. Hood. Pp. 10. (Washington, D.C.: Government Printing Office.) 5 cents. [192

Proceedings of the United States National Museum. Vol. 89, No. 3097: Seven New Crayfishes of the Genus *Cambarus* from Florida, with Notes on other Species. By Horton H. Hobbs, Jr. Pp. 387–424. (Washington, D.C.: Government Printing Office.) [192

The Engineering Foundation. Annual Report, October 1, 1939, to September 30, 1940. Pp. 48. (New York: The Engineering Foundation.) [192

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 101: Studies of the Physiology and Toxicology of Blowflies. 2: The Action of Stomach Larvicides on *Lucilia cuprina*, by F. G. Lennox; 3: The Toxicity of some Arsenicals to Larvae of *Lucilia cuprina*, by F. G. Lennox and L. G. Weber; 4: The Action of Contact Larvicides on *Lucilia cuprina*, by F. G. Lennox. Pp. 131. Pamphlet No. 102: Studies of the Physiology and Toxicology of Blowflies. 5: The Hydrogen Ion Concentration in the Alimentary Canal, by D. F. Waterhouse; 6: The Absorption and Distribution of Iron, by D. F. Waterhouse; 7: A Quantitative Examination of the Iron Content of *Lucilia cuprina*, by F. G. Lennox. Pp. 67. (Melbourne: Government Printer.) [192

Smithsonian Institution: Bureau of American Ethnology. Bulletin 127: Linguistic Material from the Tribes of Southern Texas and Northeastern Mexico. By John R. Swanton. Pp. v+145. (Washington, D.C.: Government Printing Office.) 20 cents. [192

Proceedings of the United States National Museum. Vol. 89, No. 3095: Revision of the Scarabæid Beetles of the Phyllophagan Subgenus *Listrochelus* of the United States, with Discussion of Related Subgenera. By Lawrence W. Saylor. Pp. 59–130. (Washington, D.C.: Government Printing Office.) [192

United States Department of Agriculture. Technical Bulletin No. 740: Studies of Methods and Materials for the Control of the Leafhopper *Empoasca fabæ* as a Bean Pest. By Dwight M. DeLong. Pp. 64. (Washington, D.C.: Government Printing Office.) 10 cents. [192

Bulletin of the Bingham Oceanographic Collection. Vol. 7, Art. 3: Plankton Studies, 3: Long Island Sound. By Gordon A. Riley. Pp. 93. (New Haven, Conn.: Yale University.) [192